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SYSMAC
CJ1W-NC271/NC471/NCF71/NCF71-MA
CS1W-NC271/NC471/NCF71

Position Control Units

OPERATION MANUAL

OMRON

CJ1W-NC271/NC471/NCF71/NCF71-MA
CS1W-NC271/NC471/NCF71
Position Control Units

Operation Manual

Revised September 2008

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

⚠ Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PLC” means Programmable Controller. “PC” is used, however, in some Programming Device displays to mean Programmable Controller.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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About this Manual:

This manual describes the installation and operation of the CJ1W-NC271/NC471/NCF71/NCF71-MA and CS1W-NC271/NC471/NCF71 Position Control Units and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate the Position Control Unit. Be sure to read the precautions provided in the following section.

Precautions provide general precautions for using the Position Control Unit, Programmable Controller, and related devices.

Section 1 introduces the features of the Position Control Unit, explains the system configuration in which it is used, and also provides information on basic operations, functions and specifications.

Section 2 provides an overview of the procedures required to use the Position Control Unit.

Section 3 provides information on nomenclature and functions, and describes the procedures required for wiring and installation. Information on the MECHATROLINK-II Application Module is also provided.

Section 4 provides an overview of the parameter and data settings used in Position Control Unit operation and provides information on memory allocations.

Section 5 explains how to transfer and save parameters and data using the data transfer bits.

Section 6 provides an overview of MECHATROLINK communications, and includes information on settings and procedures required to use MECHATROLINK with the Position Control Unit.

Section 7 provides an overview of the control system used by the Position Control Unit, including information on the control units, coordinate system, acceleration/deceleration operations, and limit input operations.

Section 8 provides information on the various operations used to determine the origin, including origin searches, origin returns, presetting the present position, calculating phase Z margins, and using the absolute encoder.

Section 9 provides an overview of direct operation and describes the parameter settings, data settings, and procedures required to perform direct operation. Information on interrupt feeding and torque limits is also provided here.

Section 10 describes the servo lock/unlock, jogging, override, torque limits, speed control, torque control, backlash compensation, software limits, and stop functions.

Section 11 provides basic program examples and application examples for using the Position Control Unit.

Section 12 provides information on troubleshooting errors that may occur, including details on the meaning of indicator displays and error codes, and the procedures required to reset errors in the Unit or axes.

Section 13 describes methods for inspecting and maintaining the Position Control Unit and the procedure required to replace a Position Control Unit.

The ***Appendices*** provide information on the performance characteristics, lists of parameters, I/O allocations in the operation areas, lists of error codes, alarm/warning displays, and information required when changing to the CJ1W-NC271/NC471/NCF71/NCF71-MA or CS1W-NC271/NC471/NCF71 from a CJ1W/CS1W-NC113/133/213/233/413/433 Position Control Unit.

> ⚠ **WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

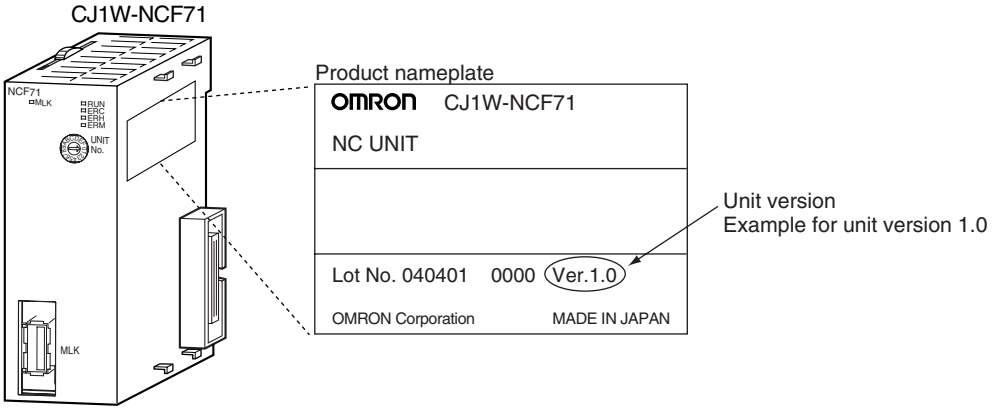
Unit Versions of Position Control Units

Unit Versions

A “unit version” has been introduced to manage Position Control Units according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

The unit version is given to the right of the lot number on the nameplate of the products for which unit versions are being managed, as shown below.



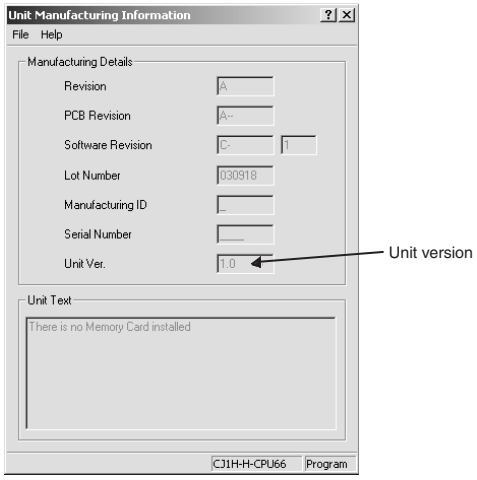
The unit version of Position Control Units starts with unit version 1.0.

Confirming Unit Versions with Support Software

CX-Programmer version 4.0 can be used to confirm the unit version using the ***Unit Manufacturing Information***.

In the *IO Table* Window, right-click the Position Control Unit and select ***Unit Manufacturing information.***

The following *Unit Manufacturing information* Dialog Box will be displayed.



The unit version is displayed as *1.0* in the *Unit Version Number* field of the above example. Use the above display to confirm the unit version of the Unit connected online.

Using Unit Version Label

A unit version label is provided with the Position Control Unit. This label can be attached to the front of the Position Control Unit to differentiate between Position Control Units with different unit versions.

Functions Supported According to Position Control Unit Versions

Model	CJ1W-NC□71/CS1W-NC□71					
	Unit Ver. 1.0	Unit Ver. 1.1	Unit Ver. 1.2	Unit Ver. 1.3	Unit Ver. 2.0	Unit Ver. 2.1
Linear interpolation	---	Supported.	Supported.	Supported.	Supported.	Supported.
Absolute encoder setup function	---	---	Supported.	Supported.	Supported.	Supported.
Deviation counter reset	---	---	---	Supported.	Supported.	Supported.
Establishing connections even when there are unconnected axes or axes with alarms that cannot be cleared	---	---	---	Supported.	Supported.	Supported.
Transferring servo parameters even when there is an axis error	---	---	---	Supported.	Supported.	Supported.
Creating servo locks during software limit detection when an absolute encoder is used	---	---	---	Supported.	Supported.	Supported.
Driver main circuit OFF error detection only when the servo is locked	---	---	---	Supported.	Supported.	Supported.
Using Holding Area address H512 and onwards for function block address allocations	---	---	---	Supported.	Supported.	Supported.
Addition of supported models: SMARTSTEP Junior Servo Drives (R7D-ZN□-ML2)	---	---	---	---	Supported.	Supported.
Addition of rejoin function	---	---	---	---	Supported.	Supported.
Eliminating connection restriction when Servo Drive alarms occur (enabling connection when alarm A.C90 occurs)	---	---	---	---	Supported.	Supported.
Addition of origin search operation modes	---	---	---	---	Supported.	Supported.
Addition of origin search preset function	---	---	---	---	Supported.	Supported.
Faster setting for transfer cycle and communications cycle when setting the absolute encoder PG zero point position offset with an origin search	---	---	---	---	---	Supported.

Upgrades Made According to Unit Versions of the Position Control Unit

Unit Version 1.0 to Unit Version 1.1

Functional upgrade	Unit version 1.0	Unit version 1.1
Addition of linear interpolation function	Linear interpolation cannot be used.	Linear interpolation can be performed for positioning operations combining one or more axes. Linear interpolation can performed for up to four axes each of axes 1 to 4 and axes 5 to 8 for Servo Drive axes connected to the Position Control Unit. (Refer to *9-7 Linear Interpolation*.)

Unit Version 1.1 to Unit Version 1.2

Functional upgrade	Unit version 1.1	Unit version 1.2
Addition of setup function for absolute encoders	An absolute encoder must be set up the first time it is used, when the rotation data is initialized to 0, or when the absolute encoder is left for a long period of time without the battery connected. With Position Control Units with unit version 1.1 or earlier, the following operation is used to set up the absolute encoder. • Special software (personal computer monitoring software) must be connected to the Servo Drive to perform the setup operation.	With Position Control Units with unit version 1.2 or later, the following operation can be used to set up the absolute encoder. • Special software (personal computer monitoring software) can be connected to the Servo Drive to perform the setup operation. • When the Position Control Unit is used with a CPU Unit with unit version 3.0 or later, the absolute encoder can be set up from the program by using a function block from the OMRON FB Library. • The absolute encoder can be set up from the CX-Motion-NCF. (Refer to *8-6-4 Absolute Encoder Setup*.)

Unit Version 1.2 to Unit Version 1.3

Functional upgrade	Unit version 1.2	Unit version 1.3
Addition of deviation counter reset function	The deviation counter in the Servo Drive cannot be reset from the Position Control Unit during position control operations.	The deviation counter in the Servo Drive can be reset from the Position Control Unit during position control operations. To deviation reset function in the Position Control Unit works by sending a movement command in the opposite direction and of the same size as the current position deviation so that the current command position equals the current feedback position. (Refer to *10-10 DEVIATION COUNTER RESET*.)

Functional upgrade	Unit version 1.2	Unit version 1.3
Establishing connections when there are unconnected axes or axes with alarms that cannot be cleared	If any of the axes registered in the scan list are not connected, have the control power supply interrupted, or have an alarm that can be reset only by cycling the power supply, an MLK initialization error (Unit error code 0020 (hex) will occur after the connections are established and operations using MECHATROLINK communications will not be possible any axes, including those without errors. To start MECHATROLINK communications normally, all errors must be cleared for all axes registered in the scan list before connections can be established.	Axis operations using MECHATROLINK communications are possible for any axes registered in the scan list and for which MECHATROLINK communications have been started (see note) regardless of whether there are Servo Drive alarms. If there are any axes with alarms, they will be indicated by the Error Flags and error code in the Axis Operating Input Memory Areas. If there are alarms in the Servo Drive that can be cleared only by recycling the power, they will be detected as Unit errors (MLK initialization errors) for Units with unit version 1.1 or earlier, but they will be detected in the individual axis areas. **Note** If R88D-WN□-ML2 W-series Servo Drives (Models with Built-in MECHATROLINK-II Communications) are connected, an encoder communications error (A.C9□) will occur in the Servo Drive and it will not be possible to start MECHATROLINK communications for Units with unit version 1.3 or earlier. (Refer to *6-3-2 MECHATROLINK Communications Status*.)
Transferring parameters when there are axis errors	Servo parameters cannot be transferred (i.e., written, read, or saved) for axes with errors. The errors must first be reset to clear the axis error status before Servo parameters can be transferred.	Servo parameters can be transferred (i.e., written, read, or saved) for axes with errors. If the axis error already exists, it will not be overwritten even if an error occurs during parameter transfer. If Servo parameters are written when there is an axis error, be sure to confirm that the parameters were transferred correctly. (Refer to *5-3 Transferring Servo Parameters*.)
Locking the servo when a software limit is being detected for a Motor with an absolute encoder	If an attempt is made to lock the Servo when an absolute encoder is used, the software limits are enabled, and the present position is within the software limit area, a software limit error will occur and the Servo lock operation will be canceled. To lock the Servo in the above situation, the software limit must first be disabled.	The Servo can be locked at any position, regardless of the type of encoder and the software limit settings. (Refer to *10-8-4 Software Limit Operation*.)

Functional upgrade	Unit version 1.2	Unit version 1.3
Detecting driver main circuit OFF errors only when the Servo is locked	Servo Drive main circuit OFF errors are detected regardless of whether the Servo is locked for the axis. Once a Servo Drive main circuit OFF error is detected, it will continue to be detected even if the error is reset until the main circuit power supply is restored.	Servo Drive main circuit OFF errors are detected only when the Servo is locked for the axis. The Position Control Unit will automatically unlock the Servo when a Servo Drive main circuit OFF error is detected, allowing the error to be cleared even while the main circuit power supply is interrupted. If an attempt is made to lock the Servo while the main circuit power supply is interrupted, a Servo Drive main circuit OFF error will be detected again. (Refer to *12-4-2 List of Error Codes*.)
Allocating holding addresses H512 and higher as function block addresses	The function blocks in the OMRON FB Library for the Position Control Unit cannot be used if H512 (default setting) or higher are allocated for non-holding areas of function block addresses. If H512 or higher are allocated, a function block error will occur when the function block is executed. The CX-Programmer must be used to change the setting to other unused words (e.g., in the DM or EM Area).	The function blocks in the OMRON FB Library for the Position Control Unit can be used if H512 (default setting) or higher are allocated for non-holding areas of function block addresses.

Unit Version 1.3 to Unit Version 2.0

Functional upgrade	Unit version 1.3	Unit version 2.0
Addition of applicable models	Applicable Models • R88D-WT□W-series Servo Drives (with JUSP-NS115 MECHATROLINK-II Application Module mounted) • R88D-WN□-ML2 W-series Servo Drives (Models with Built-in MECHATROLINK-II Communications)	Applicable Models • R88D-WT□W-series Servo Drives (with JUSP-NS115 MECHATROLINK-II Application Module mounted) • R88D-WN□-ML2 W-series Servo Drives (Models with Built-in MECHATROLINK-II Communications) • R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive (Models with Built-in MECHATROLINK-II Communications)

<table>
<tr><th>Functional upgrade</th><th>Unit version 1.3</th><th>Unit version 2.0</th></tr>
<tr><td>Addition of rejoin function</td><td>MECHATROLINK communications are started and stopped at the same time for all axes registered in the scan list.</td><td>The following functions are supported in addition to starting and stopping MECHATROLINK communications for all axes at the same time.
• Rejoin Function
An axis for which communications have been stopped, e.g., due to a communications error, can be restarted without stopping communications for the other axes. (Refer to 6-3-4 Rejoining the Connection.)
• Setting the Axes to Be Connected
Axes registered in the scan list can be set temporarily so that they are not registered. The axes can be set so that they are temporarily not used without resetting the scan list. Operations can be performed without errors occurring for these axes. (Refer to 6-3-5 Specifying the Axes to Connect.)
The Axis Communications Status Flags have also been changed for the above functions. Refer to the note following this table for details.</td></tr>
<tr><td>Eliminating connection restriction when Servo Drive alarms occur (enabling connection when alarm A.C90 occurs)</td><td>If an encoder communications error (A.C90) occurs for a R88D-WN□-ML2 W-series Servo Drive (Model with Built-in MECHATROLINK-II Communications), MECHATROLINK communications cannot be started with that Servo Drive.</td><td>MECHATROLINK communications can be started under the conditions given at the left, and operations, such as transferring Servo Parameters, can be performed.</td></tr>
<tr><td>Addition of origin search operation modes</td><td>Three origin search operation pattern are possible by combining the following settings:
• Origin search operations: 3 settings (Reversal modes 1 and 2, and Single-direction mode)
• Origin detection method: 1 setting (With origin proximity input signal reversal)</td><td>Eleven origin search operation pattern are possible by combining the following settings:
• Origin search operations: 4 settings (Reversal modes 1, 2, and 3, and Single-direction mode)
• Origin detection methods: 3 settings (With origin proximity input signal reversal, Without origin proximity input signal reversal, Not use origin proximity input signal)
<table>
<tr><th rowspan="2">Origin detection method</th><th colspan="4">Origin search operation</th></tr>
<tr><th>Reversal mode 1</th><th>Reversal mode 2</th><th>Single-direction mode</th><th>Reversal mode 3</th></tr>
<tr><td>With origin proximity input signal reversal</td><td>● (See note.)</td><td>●</td><td>●</td><td>○</td></tr>
<tr><td>Without origin proximity input signal reversal</td><td>○ (See note.)</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Not use origin proximity input signal</td><td>○ (See note.)</td><td>○</td><td>○</td><td></td></tr>
</table>
●: Combinations supported by unit version 1.3 or earlier
○: Combinations supported by unit version 2.0 or later
Note: Origin search operation patterns supported by absolute encoders.
(Refer to 8-2-4 Origin Search Operation.)</td></tr>
</table>

Functional upgrade	Unit version 1.3	Unit version 2.0
Addition of origin search preset function	The preset function cannot be used during origin searches.	The preset function can be used during origin searches. For any of the origin search operations the present position can be automatically set to any specified value at the end of the origin search. When using reversal mode 1 and an absolute encoder, an offset can also be set for the absolute origin. (Refer to *8-2-6 Origin Search Preset* and *8-6-2 Absolute Encoder Operating Procedure*.)

Note Changes in Axis Communications Status Flags
The conditions for setting and resetting the Axis Communications Status Flags in word n+22 of the Common Operating Memory Area have been changed accompanying the addition of the rejoin function. New conditions are underlined in the following table.

Functional upgrade	Unit version 1.3 or earlier	Unit version 2.0 or later
Setting conditions	• The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start.	• The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start. • The flag will turn ON when the rejoin function is used to start MECHATROLINK communications for an axis registered in the scan list.
Resetting conditions	• The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list. • The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected. • The flags will turn OFF if a Unit error occurs that requires disconnection.	• The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list. • The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected. • The flags will turn OFF if a Unit error occurs that requires disconnection. • The flags will turn OFF whenever a communications error occurs after MECHATROLINK communications have been started for the axis.

With unit version 1.3 or earlier, once MECHATROLINK communications have been started by establishing connections, the Axis Communications Status Flags will not change unless communications are disconnected (including Unit errors that required disconnection).

With unit version 2.0 or later, the Axis Communications Status Flags will turn OFF after connections have been established whenever axis operation becomes impossible due to a communications error (synchronous communications alarm or communications alarm).

Unit Version 2.0 to Unit Version 2.1

Functional upgrade	Unit version 2.0	Unit version 2.1
Faster setting of transfer cycle and communications cycle when setting the absolute encoder PG zero point position offset with an origin search	A longer communications cycle must be set using the settings given in a separate table when the absolute encoder PG zero point position offset is set with an origin search.	The same communications cycle can be set regardless of whether the absolute encoder PG zero point position offset is set with an origin search.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

PRECAUTIONS

This section provides general precautions for using the Position Control Unit and related devices.

The information contained in this section is important for the safe and reliable application of Position Control Units. You must read this section and understand the information contained before attempting to set up or operate a Position Control Unit.

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1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠WARNING It is extremely important that a Position Control Units and related devices be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying Position Control Units and related devices to the above-mentioned applications.

3 Safety Precautions

⚠WARNING Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

⚠WARNING Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠WARNING Never touch any of the terminals while power is being supplied. Doing so may result in serious electric shock.

⚠WARNING Provide safety measures in external circuits (i.e., not in the Programmable Controller or Position Control Unit) to ensure safety in the system if an abnormality occurs due to malfunction of the PLC, malfunction of the PCU (Position Control Unit), or external factors affecting the operation of the PLC or PCU. Not providing sufficient safety measures may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
- The PLC or PCU outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-V DC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- External safety measures must also be taken to ensure safety in the event of unexpected operation when connecting or disconnecting the PCU's connectors.

⚠ **Caution** Execute online editing only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.

⚠ **Caution** Confirm safety at the destination node before transferring a program to another node or changing contents of the I/O memory area. Doing either of these without confirming safety may result in injury.

4 Operating Environment Precautions

⚠ **Caution** Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠Caution The operating environment of the PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. Make sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5 Application Precautions

Observe the following precautions when using the PLC System.

⚠WARNING Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.

- Always connect to a ground of 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the PLC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting Power Supply Units, I/O Units, CPU Units, Inner Boards, or any other Units.
  - Assembling the Units.
  - Setting DIP switches or rotary switches.
  - Connecting cables or wiring the system.
  - Connecting or disconnecting the connectors.

⚠Caution Failure to abide by the following precautions could lead to faulty operation of the PLC, the PCU, or the system, or could damage the PLC or PCU. Always heed these precautions.

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may cause malfunction resulting in serious injury.
- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- For CS-series PLCs, always tighten the mounting screw at the bottom of the PCU to a torque of 0.4 N·m.
- For CJ-series PLCs, lock the sliders securely until they click into place when connecting the Power Supply Unit, CPU Unit, I/O Units, Special I/O Units, or CPU Bus Units. Functions may not work correctly if the sliders are not locked properly.
- Always attach the End Cover provided with the CPU Unit to the Unit on the right end of the PLC. The CJ-series PLC will not operate properly if the End Cover is not attached.

- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Disconnect the LG (line ground) terminal and GR (ground) terminal before performing withstand voltage and insulation resistance tests.
- Confirm that set parameters and data operate properly.
- Perform wiring according to specified procedures.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
    - Changing the operating mode of the PLC (including setting the Startup Mode).
    - Force-setting/force-resetting any bit in memory.
    - Changing the present value of any word or any set value in memory.
- After replacing Units, resume operation only after transferring to the new CPU Unit, Special I/O Units, CPU Bus Units, and externally connected devices the contents of the DM Area, Holding Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up. Not doing so may result in malfunction or damage.
- Never turn OFF the power to the Unit while transferring data.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives

6-2 Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Note Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN61000-6-2
EMI (Electromagnetic Interference): EN61000-6-4
(Radiated emission: 10-m regulations)

6-3 Conformance to EC Directives

The PCUs comply with EC Directives. To ensure that the machine or device in which a PCU is used complies with EC Directives, the PCU must be installed as follows:

1,2,3...

1. The PCU is defined as a in-panel device and must be installed within a control panel.
2. Reinforced insulation or double insulation must be used for the DC power supplies used for I/O.
3. PCUs complying with EC directives also meet the common emission standard (EN61000-6-4). The measures required to ensure that the standard is met will vary with the overall configuration of the control panel, the other devices connected to the control panel, wiring, and other conditions. The customer must therefore confirm that EC directives are met for the overall machine or device, particularly for the radiated emission requirement (10 m).

6-4 Installation within Control Panels

Unnecessary clearance in cable inlet or outlet ports, operation panel mounting holes, or in the control panel door may cause electromagnetic wave leakage or interference. In this case, the product may fail to meet EC Directives. In order to prevent such interference, fill clearances in the control panel with conductive packing. (In places where conductive packing comes in contact with the control panel, ensure electrical conductivity by removing the paint coating or masking these parts when painting.)

SECTION 1
Features and System Configuration

This section introduces the features of the Position Control Unit, explains the system configuration in which it is used, and also provides information on basic operations, functions and specifications.

1-1 Features 2
1-2 System Configuration 3
1-3 Basic Operations 4
1-3-1 Position Control (Direct Operation) 4
1-3-2 Speed Control and Torque Control 5
1-3-3 Other Operations 5
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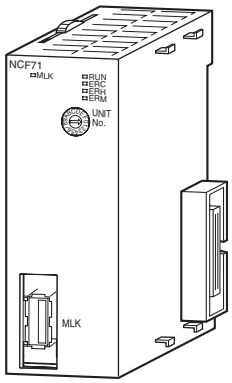
1-4-2 List of Functions and Specifications 6
1-5 List of Functions by Purpose 8
1-6 Comparison with Existing Models 9

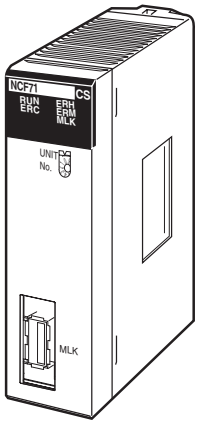
1-1 Features

Position Control Unit

CJ1W-NC271/471/F71



CS1W-NC271/471/F71



The Position Control Unit is a CS/CJ-series CPU Bus Unit. The Position Control Unit (PCU) receives commands from the CPU Unit's internal Auxiliary Area and outputs positioning commands to MECHATROLINK-II Servo Drives.

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Compatible with the MECHATROLINK-II High-speed Field Network

A MECHATROLINK-II high-speed (10 Mbps) communications interface is used to control Servo Drives for up to 16 axes with a single CS/CJ-series Unit. Shielded twisted-pair cables in daisy-chain formation make wiring simple and enable multi-axis systems that require less wiring and are smaller in size.

High-speed, High-precision Control Using Data Communications

Optimal motor performance can be achieved by transmitting data using communications between the Programmable Controller (PLC) and Servo Drives, without having to set an upper limit for the designated speed. High-speed and high-precision position control using high-resolution motors are possible.

Position Control (Direct Operation)

Positioning can be performed simply by directly setting the target position and target speed from the CPU Unit. Positioning to either absolute or relative positions is also possible. Interrupt feeding is also supported. With interrupt feeding, positioning is continued for a specified amount after an interrupt input signal is received, and then the axis is stopped.

Speed Control and Torque Control

The Servo Drive's speed and torque can be controlled by directly specifying the target speed and torque from the CPU Unit.

Compatible with Servomotors with Absolute Encoders

The PCU is compatible with Servomotors that have absolute encoders. Using such Servomotors eliminates the need to repeatedly perform origin searches.

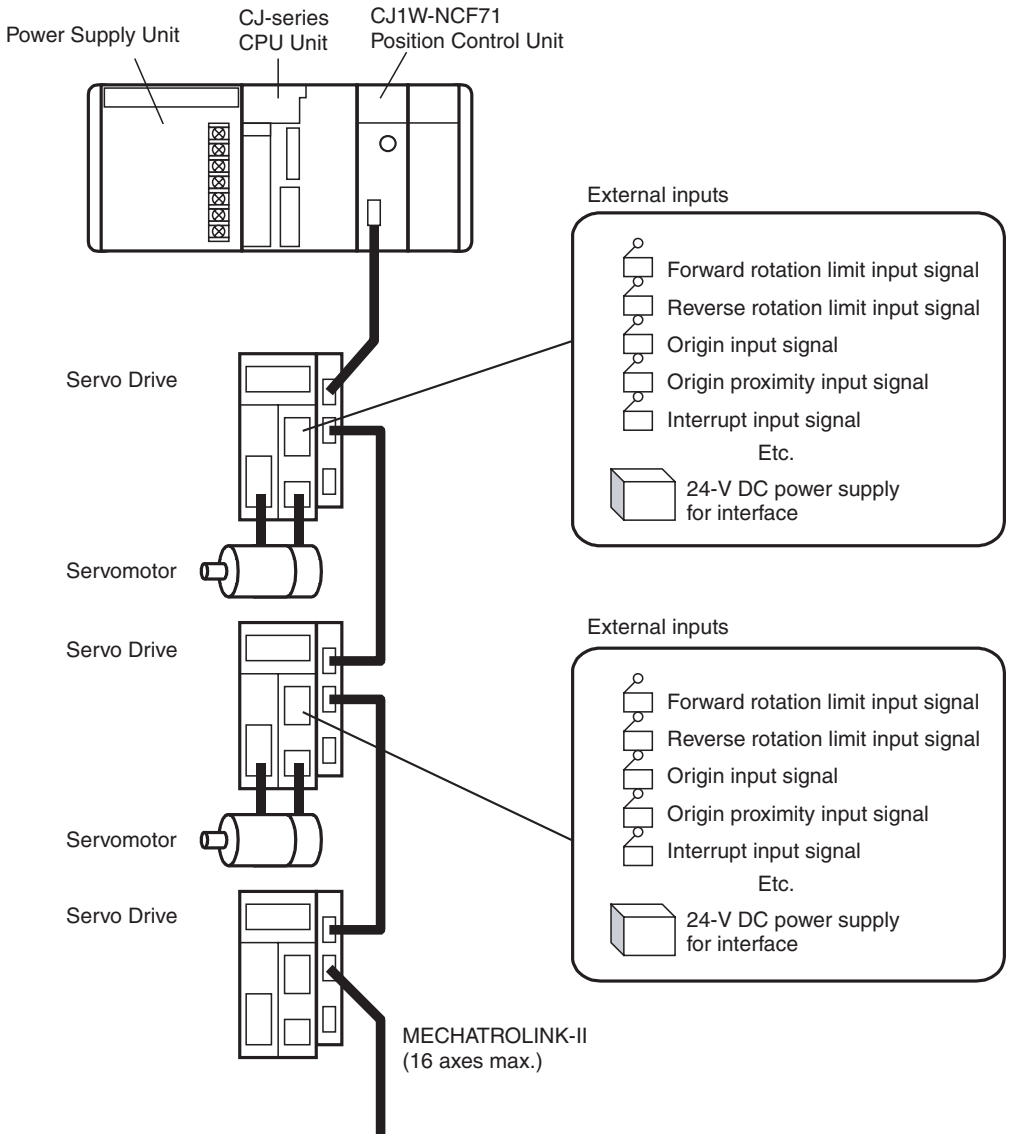
Transfer Data between Host PLC and Servo Drive

The Servo Drive's parameters and monitors can be set from the CPU Unit. All the data for the multi-axis system can be centrally controlled from the host PLC. This removes the difficulty in starting up devices or setting data when replacing a Unit.

1-2 System Configuration

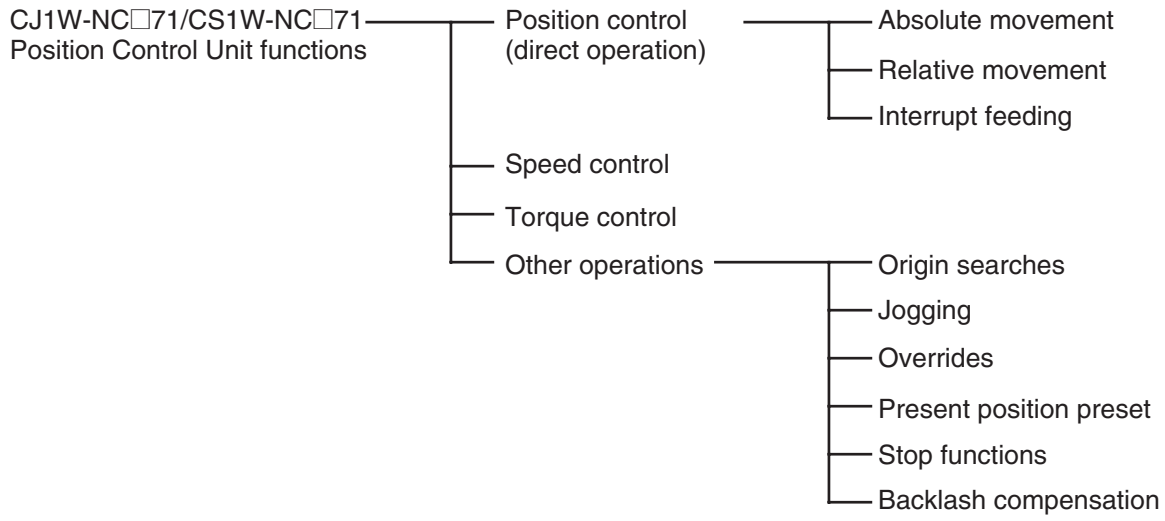
The PCU receives commands from the CPU Unit's ladder program and control signal status (forward/reverse rotation limit, origin, origin proximity, and interrupt input signals) from devices connected externally to the Servo Drive, and uses them to control Servo Drive positioning.

System Configuration Example



1-3 Basic Operations

The PCU's operations are as follows:

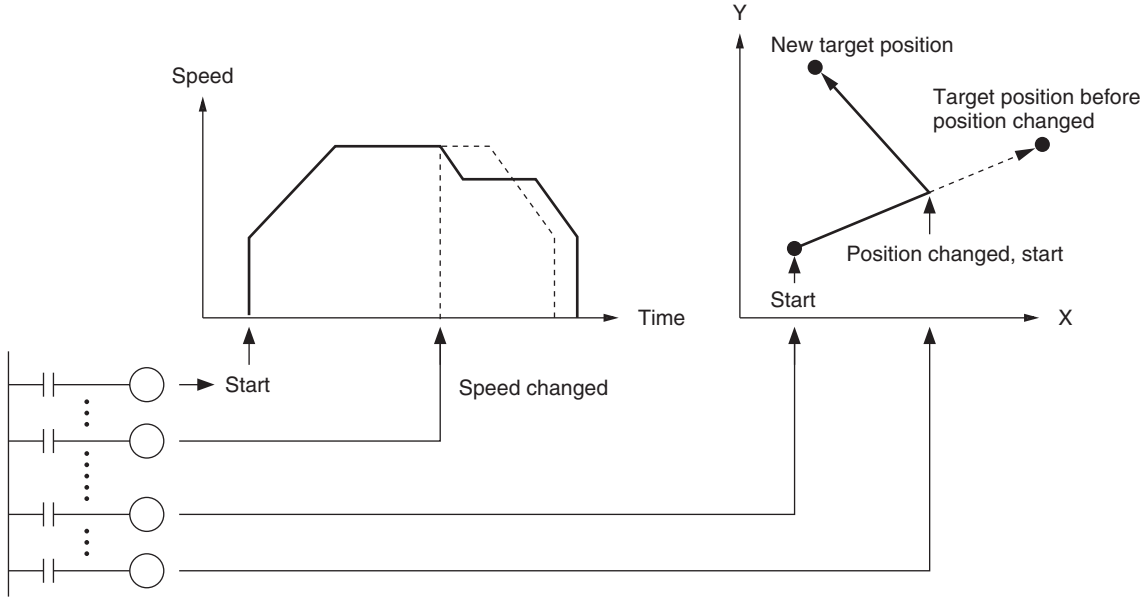


1-3-1 Position Control (Direct Operation)

Positioning can be executed either to an absolute position (i.e., to an absolute position from the origin) or to an incremental position (i.e., to a position relative to the present position). Interrupt feeding is also possible, whereby an axis is moved a specified amount when an interrupt input signal is received and then stopped.

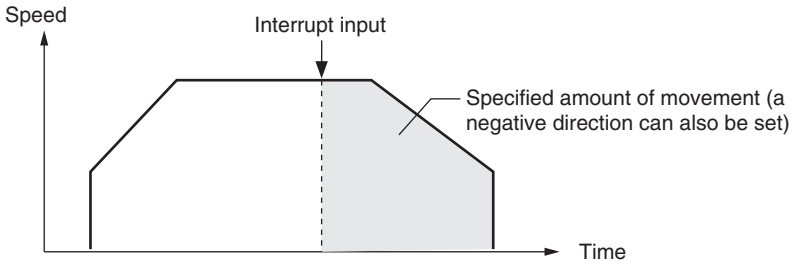
Absolute Movements and Relative Movements

With absolute and relative movements, position and speed data are set directly from the ladder program in the CPU Unit. Positioning is executed according to operating commands sent to the PCU from the CPU Unit. It is also possible to change the speed or to send commands to move axes to different positions while positioning is being performed.



Interrupt Feeding

When an interrupt input signal is received, positioning is continued for the specified amount of movement and then stopped.



Linear Interpolation

Linear interpolation can be performed for a combination of axes (Unit Ver. 1.1 or later).

1-3-2 Speed Control and Torque Control

Speed command data and torque command data are set from the CPU Unit. Speed control and torque control of the Servomotor are executed by sending operating commands to the PCU from the CPU Unit.

1-3-3 Other Operations

Origin Searches

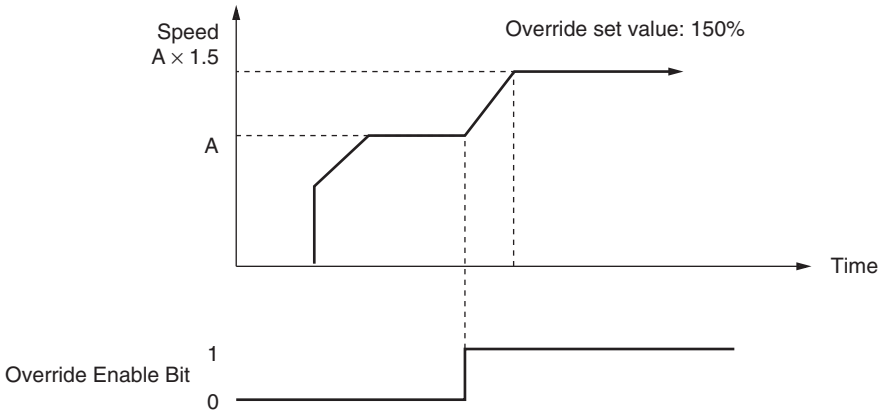
The origin search operations find the origin for a designated axis.

Jogging

Jogging moves a specified axis at a designated speed and then stops it.

Overrides

When an override is enabled during positioning, the target speed is changed to the override speed.



Present Position Preset (Changing the Present Position)

The PRESENT POSITION PRESET command changes the present position to a specified position.

Stop Functions

The DECELERATION STOP command decelerates positioning to a stop.

The EMERGENCY STOP command cancels operating commands immediately and stops the axis after moving it for the number of pulses remaining in the Servo Drive's deviation counter.

1-4 List of Functions and Specifications

1-4-1 General Specifications

Item	Specification	
Model	CJ1W-NC271/471/F71	CS1W-NC271/471/F71
Internal current consumption	360 mA max. at 5 V DC	
Dimensions	31 × 90 × 65 mm (W × H × D)	130 × 35 × 101 mm (W × H × D)
Weight	95 g max.	188 g max.
Ambient operating temperature	0 to 55°C	
Approved standards	CE, cULus, and C-tick	

Specifications not listed above conform to general CS/CJ Series specifications.

1-4-2 List of Functions and Specifications

Item		Specification
Unit classification		CPU Bus Unit
Applicable PLCs		CS/CJ Series
Possible unit number settings		0 to F
I/O allocations	Common Operating Memory Area	Words allocated in CPU Bus Unit Area: 25 words (15 output words, 10 input words)
	Axis Operating Memory Area	Allocated in one of the following areas (user-specified): CIO, Work, Auxiliary, Holding, DM, or EM Area. Number of words allocated: 50 words (25 output words, 25 input words) × Highest axis No. used
Compatible devices		• OMRON G-series Servo Drives (Built-in MECHATROLINK-II communications) • OMRON W-series Servo Drives (equipped with MECHATROLINK-II Application Module or built-in MECHATROLINK-II communications) • OMRON SMARTSTEP Junior Servo Drives (Built-in MECHATROLINK-II communications) **Note** SMARTSTEP Junior Servo Drive are supported by Position Control Units with unit version 2.0 or later.
Control method		Control commands executed using MECHATROLINK-II synchronous communications.
Maximum number of controlled axes		CS1W/CJ1W-NC271: 2 axes, CS1W/CJ1W-NC471: 4 axes, CS1W/CJ1W-NCF71: 16 axes
Control units	Position command unit	Command unit: Depends on the Electronic Gear Setting in the Servo Parameters. Default setting: Pulses
	Speed command unit for position control	Command units/s
	Acceleration/deceleration speeds for position control	10,000 command units/s^2
	Speed command unit for speed control	0.001% of the motor's momentary maximum rotation speed
	Torque command unit for torque control	0.001% of the motor's momentary maximum torque

Item		Specification
Control command range	Position command range	–2,147,483,648 to 2,147,483,647 (command units)
	Speed command range for position control	0 to 2,147,483,647 (command units/s)
	Acceleration/deceleration speeds for position control	1 to 65,535 (10,000 command units/s^2)
	Speed command range for speed control	–199.999% to 199.999% The upper limit of the speed command range depends on the specifications of the Servo Drive.
	Torque command range for torque control	–199.999% to 199.999% The upper limit of the torque command range depends on the specifications of the Servo Drive.
Control functions	Servo lock/unlock	Creates (Servo lock) or releases (Servo unlock) the position loop on the PCU.
	Position control	Positions to an absolute position or relative position according to the target position and target speed specified from the ladder program.
	Origin determination	• Origin search: Establishes the origin using the specified search method. • Present position preset: Changes the present position to a specified position to establish the origin. • Origin return: Returns the axis from any position to the established origin. • Absolute encoder origin: Establishes the origin using a Servomotor that has an absolute encoder, without having to use an origin search.
	Jogging	Outputs pulses at a fixed speed in the forward rotation or reverse rotation direction.
	Interrupt feeding	Performs positioning by moving the axis a fixed amount when an external interrupt input is received while the axis is moving.
	Speed control	Performs speed control by sending a command to the Servo Drive speed loop.
	Torque control	Performs torque control by sending a command to the Servo Drive current loop.
	Stop functions	• Deceleration stop: Decelerates the moving axis to a stop. • Emergency stop: Positions the moving axis for the number of pulses remaining in the deviation counter and then stops the axis.
Auxiliary functions	Acceleration/deceleration curves	Sets one of the following: a trapezoidal (linear) curve, an exponential curve, or an S-curve (moving average).
	Torque limit	Restricts the output torque during axis operation.
	Override	Multiplies the axis command speed by a specified ratio. Override: 0.01% to 327.67%
	Servo parameter transfer	Reads and writes the Servo Drive parameters from the ladder program in the CPU Unit.
	Monitoring function	Monitors the control status of the Servo Drive, such as the command coordinate positions, feedback position, current speed, and torque.
	Software limits	Limits software operation within the positioning range during position control.
	Backlash compensation	Compensates for the amount of play in the mechanical system according to a set value.
	Deviation counter reset	The position deviation in the Servo Drive's deviation counter can be reset to 0 (unit version 1.3 or later).
External I/O	Position Control Unit	One MECHATROLINK-II interface port
	Servo Drive I/O	Forward/reverse rotation limit inputs, origin proximity inputs, external interrupt inputs 1 to 3 (can be used as external origin inputs)

Item	Specification
Self-diagnostic functions	Watchdog, flash memory check, memory corruption check
Error detection functions	Overtravel, Servo Drive alarm detection, CPU error, MECHATROLINK communications error, Unit setting error

1-5 List of Functions by Purpose

Purpose	Category	Name	Basic function	Details
Establishing the mechanical origin of the machine	Origin determination	Origin search	The motor is operated to established the origin.	*8-2 Origin Search Operation*
		Present position preset	The position where the motor is stopped is set to a specified position to establish the origin.	*8-3 Present Position Preset*
		Origin return	The axis is returned to the established origin.	*8-4 Origin Return*
		Absolute encoder origin	The origin is established using a Servomotor with an absolute encoder, so origin searches are not required at machine startup.	*8-6 Absolute Encoder Origin*
Point-to-point (PTP) positioning	Position control	Direct operation (absolute movement or relative movement)	The position and speed are specified to perform positioning using an absolute or relative movement.	*9-4 Using Direct Operation*
Changing the target position and speed as required during positioning		Direct operation: Changing target position or changing target speed	The target position or target speed is changed during positioning with direct operation.	*9-4-3 Changing Target Position* *9-4-4 Changing Target Speed*
Performing positioning for a specified distance from an external input point during positioning		Interrupt feeding	When an interrupt input signal turns ON during positioning with direct operation, operation switches to positioning for a fixed amount.	*9-5 Interrupt Feeding*
Performing manual feeding for adjustment or other purpose		Jogging	The axis is moved at a fixed speed in the forward rotation or reverse rotation direction.	*10-2 Jogging*
Reducing shock while device is operating	Auxiliary functions	Acceleration/deceleration curves	Acceleration/deceleration is performed according to the basic trapezoidal curve (linear acceleration/deceleration), an exponential curve, or an S-curve, which greatly helps to reduce mechanical vibration.	*7-4 Acceleration and Deceleration Operations*
Temporarily multiplying the machine's operating speed by a constant ratio to perform startup adjustments		Overrides	The axis command speed is multiplied by a constant ratio.	*10-3 Override*
Restricting output torque during control operations such as pushing control		Torque limit	A constant limit is applied to the output torque of the Servomotor during positioning.	*10-4 Torque Limits*
Stopping the device during operation	Stop function	Deceleration stop or emergency stop	The moving axis is decelerated to a stop or the axis is moved for the number of pulses remaining in the deviation counter and then stopped.	*10-9 Stop Functions*
Changing the Servo Drive settings from the PLC	Data transfer function	Reading/writing Servo parameters	Servo Drive parameters are read or written from the CPU Unit.	*5-3 Transferring Servo Parameters*

Purpose	Category	Name	Basic function	Details
Performing speed feeding in rotary control such as sheet feeding.	Speed control	Speed control	The speed command value is directly specified to control the Servomotor rotation.	*10-5 Speed Control*
Changing the output torque sequentially during control operations such as tightening.	Torque control	Torque control	The torque command value is directly specified to control the Servomotor's output torque.	*10-6 Torque Control*

1-6 Comparison with Existing Models

Functions and performance	CJ1W-NC□71 CS1W-NC□71	CJ1W-NC□13/□33 CS1W-NC□13/□33
Unit type	CPU Bus Unit	Special I/O Unit
Unit number allocation	Unit numbers can be set from 0 to F (CPU Bus Units).	Unit numbers can be set from 0 to 95. • One-axis and two-axis PCUs: One unit number used. • Four-axis PCUs: Two unit numbers used.
Control method	Commands are executed using MECHATROLINK-II synchronous communications.	Open-loop control is performed using a pulse train output.
Format of data exchanged between PLC and PCU	Binary (hexadecimal) Example: Present position is output to the PLC in 32-bit signed binary format.	Same as CJ1W-NC□71/CS1W-NC□71.
Position command range	–2,147,483,648 to 2,147,483,647 (Unit depends on Servo Parameters)	–1,073,741,823 to 1,073,741,823 pulses
Present position range	–2,147,483,648~2,147,483,647 (Unit depends on Servo parameters)	–2,147,483,647 to 2,147,483,647 pulses
Zone range	No zone functions	–1,073,741,823 to 1,073,741,823 pulses
Speed command range	Position control: 0 to 2,147,483,647 (command units/s) (Upper limit speed depends on Servo Drive and Servomotor.) Speed control: –199.999% to 199.999% (percentage of Servomotor's momentary maximum rotation speed) The upper limit of the speed command range depends on the specifications of the Servo Drive.	1 to 500,000 (unit: 1 pps)
Torque command range	–199.999% to 199.999% (percentage of Servomotor's momentary maximum torque) The upper limit of the torque command range depends on the specifications of the Servo Drive.	None
Overrides	0.01% to 327.67% in increments of 0.01%	1% to 999% in increments of 1%
Memory operation function	None	Absolute/relative movement, linear interpolation, interrupt feeding, speed control, forced interrupt, and teaching

Functions and performance	CJ1W-NC□71 CS1W-NC□71	CJ1W-NC□13/□33 CS1W-NC□13/□33
Origin search	Origin search method: • The origin input signal is detected after the origin proximity input signal turns OFF. • The origin input signal is detected after the origin proximity input signal turns ON. (Unit version 2.0 or later) • The origin input signal is detected without using the origin proximity input signal. (Unit version 2.0 or later) Origin compensation: After detecting the origin input signal, positioning is performed for the origin return final travel distance (specified in Servo Parameters).	Origin search methods: • The origin input signal is detected after the origin proximity input signal turns ON. • The origin input signal is detected after the origin proximity input signal turns OFF. • The origin input signal is detected without using the origin proximity input signal. Origin compensation: The axis is moved for the amount specified by the origin compensation data (specified from the Unit) at the proximity speed.
Acceleration/deceleration curves	Trapezoidal curve, exponential curve, or S-curve S-curve acceleration/deceleration uses a moving average.	Trapezoidal curve or S-curve S-curve acceleration/deceleration uses a tertiary function.
Setting acceleration/deceleration speeds	Accelerations and decelerations are specified in units of 10,000 command units/s^2. Servo parameters are set individually for each axis.	The times in milliseconds required to reach the maximum speed from the initial speed and to reach the initial speed from the maximum speed are specified Direct operation: Acceleration/deceleration speeds are specified as operation data from the PLC. Memory operation: Up to 9 acceleration/deceleration speeds per axis are recorded in the Unit.
Deviation counter reset	Supported (unit version 1.3 or later).	Supported.
Emergency stop	A hardware input contact is not provided on the Position Control Unit. Stopping is possible after moving the number of pulses remaining in the deviation counter by using an allocated operation bit.	The PCU's hardware input contact is used.
Data transfer method	Writes/reads using the Data Transfer Bit.	• Data can be read or written using the Data Transfer Bit. • Data can be read or written using the IOWR/IORD instruction.
Saving data	Parameters can be saved to the flash memory in the PCU. Servo Parameters are saved in the Servo Drive.	Axis Parameters and Zone Data are saved in the flash memory in the PCU.
CPU Unit cycle time extension for END refresh	1 ms max. per 16 axes (using the CS1/CJ1-H CPU Unit)	0.5 ms max. per PCU
Response time	4 ms max. (time from when the start commands for the ladder program are sent until the Servo Drive receives the control command when four axes are connected) (See note.)	4 ms max. (time from when the start commands for the ladder program are sent until the Position Control Unit performs pulse output when all axes of a four-axis Unit are being operated simultaneously)

Note The response time depends on the cycle time of the PLC and the MECHATROLINK communications settings. The time shown in the table is the maximum value obtained when calculated according to specified measurement conditions. For details, refer to *Appendix A Performance Characteristics*.

SECTION 2
Basic Procedures

This section provides an overview of the procedures required to use the Position Control Unit.

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2-2-1 Overview of Operation 16
2-2-2 System Configuration and Wiring 16
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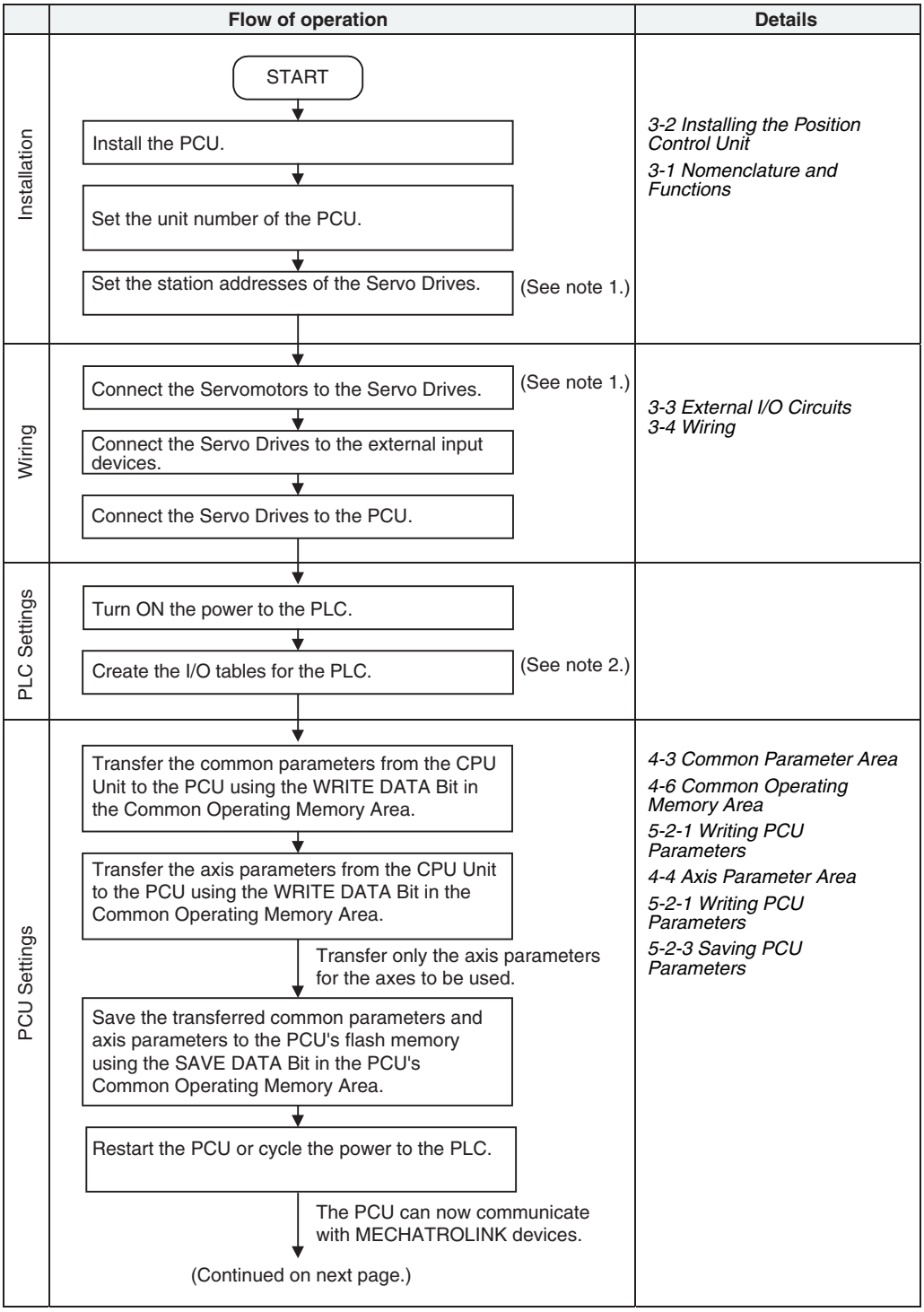
2-2-5 Setting Servo Parameters 22
2-2-6 Operating the Servomotor from the PCU 25

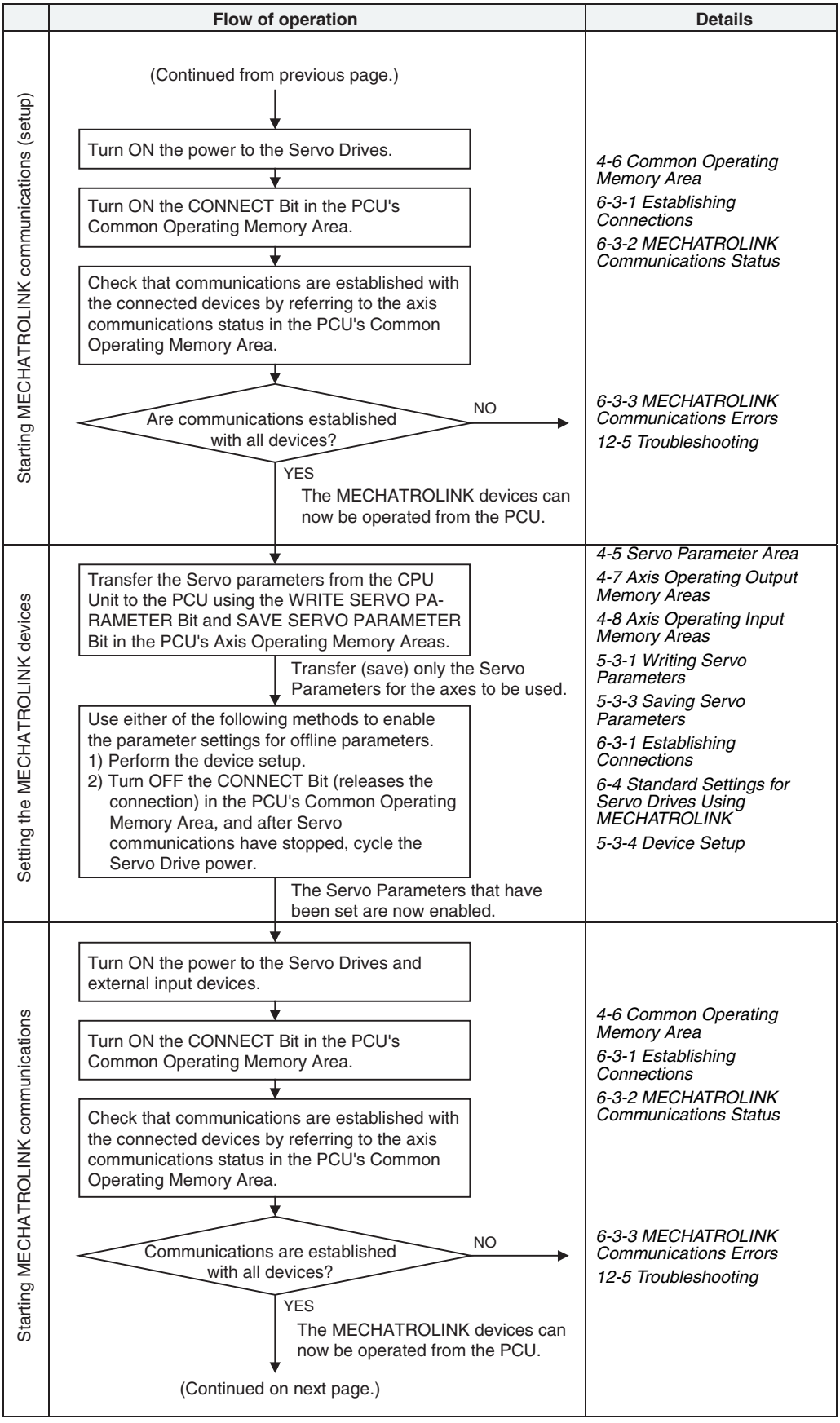
2-1 Basic Flow of Operations

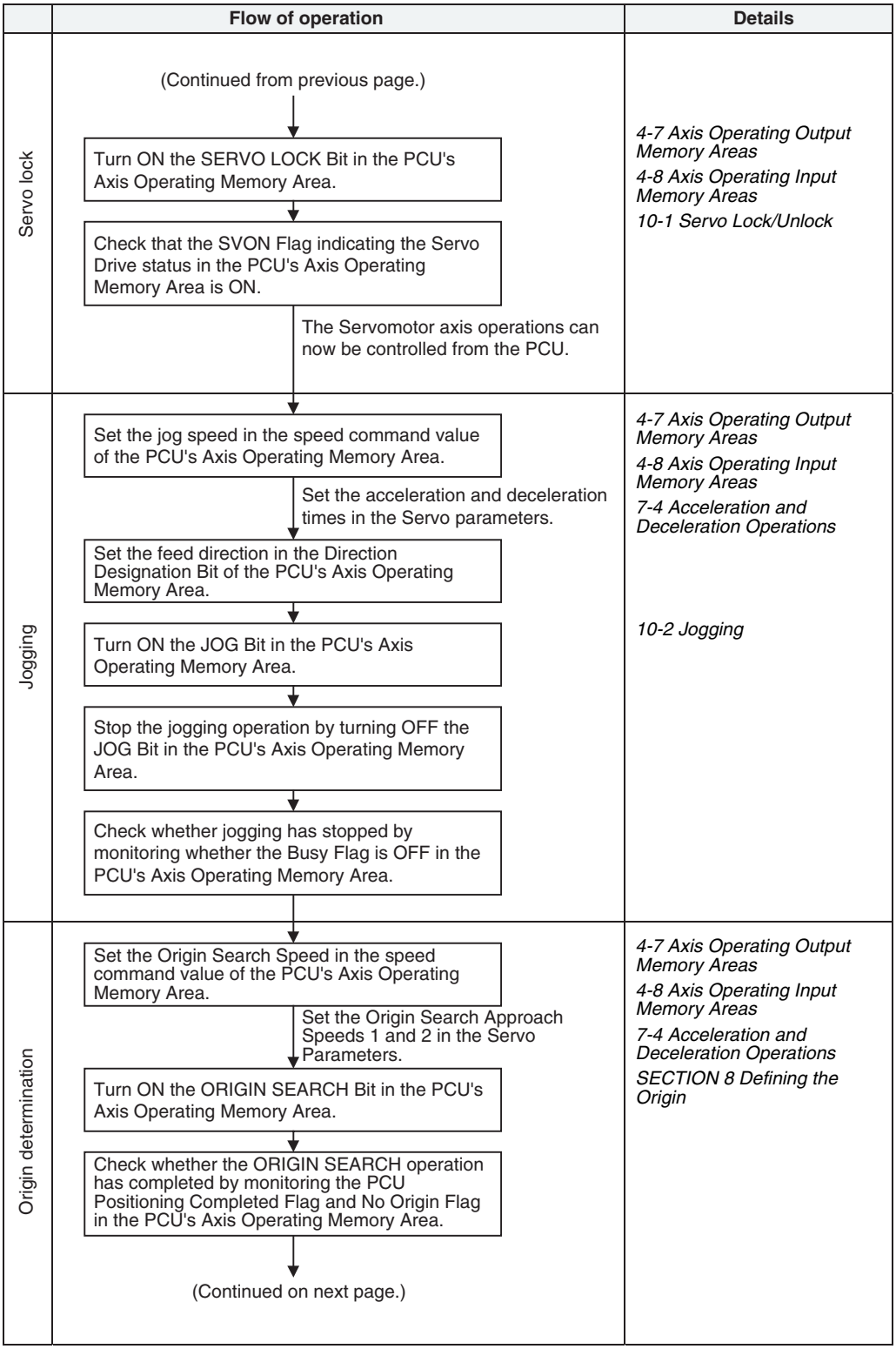
The basic flow of Position Control Unit (PCU) operation is described in this section. The steps from installation through setting the MECHATROLINK devices are required only when installing the devices for the first time. When PCU and MECHATROLINK device settings have been completed, start operation from starting MECHATROLINK communications in the flow of operation.

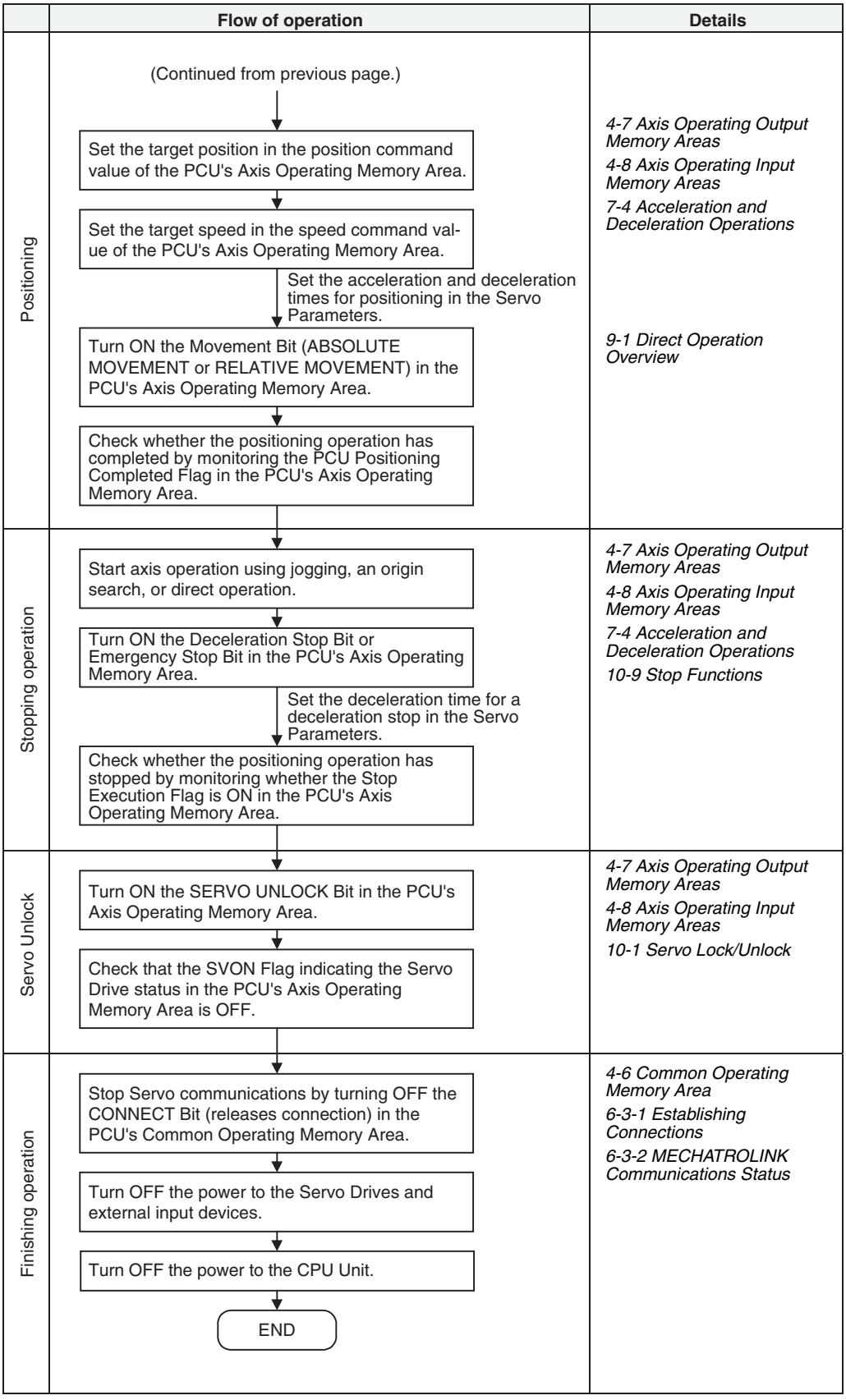

Flow of operation
Details
Installation
START
Install the PCU.
Set the unit number of the PCU.
Set the station addresses of the Servo Drives.
(See note 1.)
3-2 Installing the Position Control Unit
3-1 Nomenclature and Functions
Wiring
Connect the Servomotors to the Servo Drives.
(See note 1.)
Connect the Servo Drives to the external input devices.
Connect the Servo Drives to the PCU.
3-3 External I/O Circuits
3-4 Wiring
PLC Settings
Turn ON the power to the PLC.
Create the I/O tables for the PLC.
(See note 2.)
PCU Settings
Transfer the common parameters from the CPU Unit to the PCU using the WRITE DATA Bit in the Common Operating Memory Area.
Transfer the axis parameters from the CPU Unit to the PCU using the WRITE DATA Bit in the Common Operating Memory Area.
Transfer only the axis parameters for the axes to be used.
Save the transferred common parameters and axis parameters to the PCU's flash memory using the SAVE DATA Bit in the PCU's Common Operating Memory Area.
Restart the PCU or cycle the power to the PLC.
The PCU can now communicate with MECHATROLINK devices.
(Continued on next page.)
4-3 Common Parameter Area
4-6 Common Operating Memory Area
5-2-1 Writing PCU Parameters
4-4 Axis Parameter Area
5-2-1 Writing PCU Parameters
5-2-3 Saving PCU Parameters

Note (1) Perform wiring according to instructions given in the Servomotor and Servo Drive's operation manuals.

(2) Refer to the *CJ Series PLC Operation Manual*.


Flow of operation
Details
Starting MECHATROLINK communications (setup)
(Continued from previous page.)
Turn ON the power to the Servo Drives.
Turn ON the CONNECT Bit in the PCU's Common Operating Memory Area.
Check that communications are established with the connected devices by referring to the axis communications status in the PCU's Common Operating Memory Area.
Are communications established with all devices?
NO
YES
The MECHATROLINK devices can now be operated from the PCU.
4-6 Common Operating Memory Area
6-3-1 Establishing Connections
6-3-2 MECHATROLINK Communications Status
6-3-3 MECHATROLINK Communications Errors
12-5 Troubleshooting
Setting the MECHATROLINK devices
Transfer the Servo parameters from the CPU Unit to the PCU using the WRITE SERVO PARAMETER Bit and SAVE SERVO PARAMETER Bit in the PCU's Axis Operating Memory Areas.
Transfer (save) only the Servo Parameters for the axes to be used.
Use either of the following methods to enable the parameter settings for offline parameters.
1) Perform the device setup.
2) Turn OFF the CONNECT Bit (releases the connection) in the PCU's Common Operating Memory Area, and after Servo communications have stopped, cycle the Servo Drive power.
The Servo Parameters that have been set are now enabled.
4-5 Servo Parameter Area
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
5-3-1 Writing Servo Parameters
5-3-3 Saving Servo Parameters
6-3-1 Establishing Connections
6-4 Standard Settings for Servo Drives Using MECHATROLINK
5-3-4 Device Setup
Starting MECHATROLINK communications
Turn ON the power to the Servo Drives and external input devices.
Turn ON the CONNECT Bit in the PCU's Common Operating Memory Area.
Check that communications are established with the connected devices by referring to the axis communications status in the PCU's Common Operating Memory Area.
Communications are established with all devices?
NO
YES
The MECHATROLINK devices can now be operated from the PCU.
(Continued on next page.)
4-6 Common Operating Memory Area
6-3-1 Establishing Connections
6-3-2 MECHATROLINK Communications Status
6-3-3 MECHATROLINK Communications Errors
12-5 Troubleshooting


Flow of operation
Details
Servo lock
(Continued from previous page.)
Turn ON the SERVO LOCK Bit in the PCU's Axis Operating Memory Area.
Check that the SVON Flag indicating the Servo Drive status in the PCU's Axis Operating Memory Area is ON.
The Servomotor axis operations can now be controlled from the PCU.
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
10-1 Servo Lock/Unlock
Jogging
Set the jog speed in the speed command value of the PCU's Axis Operating Memory Area.
Set the acceleration and deceleration times in the Servo parameters.
Set the feed direction in the Direction Designation Bit of the PCU's Axis Operating Memory Area.
Turn ON the JOG Bit in the PCU's Axis Operating Memory Area.
Stop the jogging operation by turning OFF the JOG Bit in the PCU's Axis Operating Memory Area.
Check whether jogging has stopped by monitoring whether the Busy Flag is OFF in the PCU's Axis Operating Memory Area.
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
7-4 Acceleration and Deceleration Operations
10-2 Jogging
Origin determination
Set the Origin Search Speed in the speed command value of the PCU's Axis Operating Memory Area.
Set the Origin Search Approach Speeds 1 and 2 in the Servo Parameters.
Turn ON the ORIGIN SEARCH Bit in the PCU's Axis Operating Memory Area.
Check whether the ORIGIN SEARCH operation has completed by monitoring the PCU Positioning Completed Flag and No Origin Flag in the PCU's Axis Operating Memory Area.
(Continued on next page.)
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
7-4 Acceleration and Deceleration Operations
SECTION 8 Defining the Origin


Flow of operation
Details
Positioning
(Continued from previous page.)
Set the target position in the position command value of the PCU's Axis Operating Memory Area.
Set the target speed in the speed command value of the PCU's Axis Operating Memory Area.
Set the acceleration and deceleration times for positioning in the Servo Parameters.
Turn ON the Movement Bit (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT) in the PCU's Axis Operating Memory Area.
Check whether the positioning operation has completed by monitoring the PCU Positioning Completed Flag in the PCU's Axis Operating Memory Area.
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
7-4 Acceleration and Deceleration Operations
9-1 Direct Operation Overview
Stopping operation
Start axis operation using jogging, an origin search, or direct operation.
Turn ON the Deceleration Stop Bit or Emergency Stop Bit in the PCU's Axis Operating Memory Area.
Set the deceleration time for a deceleration stop in the Servo Parameters.
Check whether the positioning operation has stopped by monitoring whether the Stop Execution Flag is ON in the PCU's Axis Operating Memory Area.
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
7-4 Acceleration and Deceleration Operations
10-9 Stop Functions
Servo Unlock
Turn ON the SERVO UNLOCK Bit in the PCU's Axis Operating Memory Area.
Check that the SVON Flag indicating the Servo Drive status in the PCU's Axis Operating Memory Area is OFF.
4-7 Axis Operating Output Memory Areas
4-8 Axis Operating Input Memory Areas
10-1 Servo Lock/Unlock
Finishing operation
Stop Servo communications by turning OFF the CONNECT Bit (releases connection) in the PCU's Common Operating Memory Area.
Turn OFF the power to the Servo Drives and external input devices.
Turn OFF the power to the CPU Unit.
END
4-6 Common Operating Memory Area
6-3-1 Establishing Connections
6-3-2 MECHATROLINK Communications Status

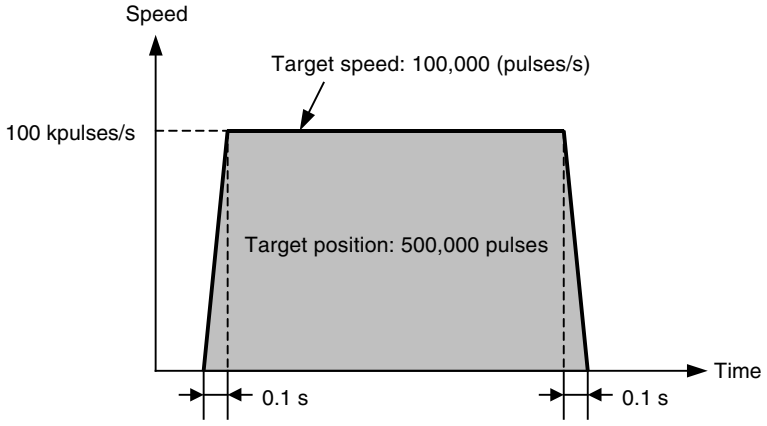
2-2 Starting Operation

Examples of operating the Servomotor using RELATIVE MOVEMENT commands for direct operation are provided in this section for first-time users of a PCU.

2-2-1 Overview of Operation

The following example is for operating the Servomotor using direct operation under the following operation conditions. An OMRON W-series Servomotor and a Servo Drive with a Yaskawa JUSP-NS115 MECHATROLINK-II Application Module installed is used.

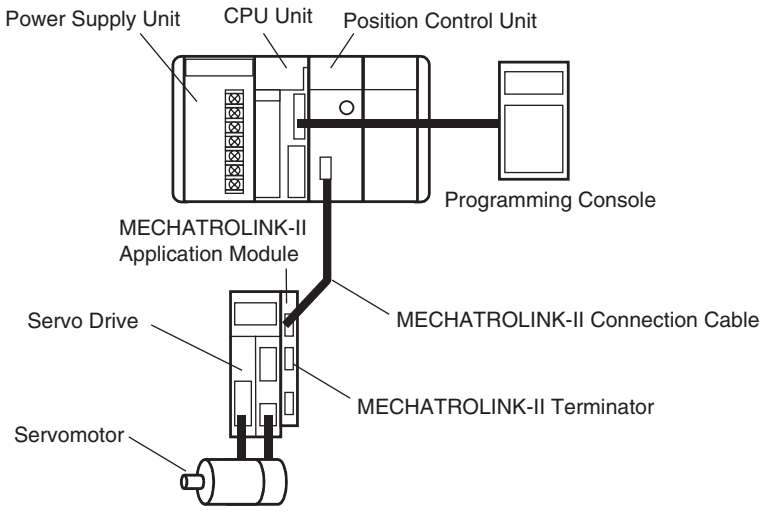
Only the minimum parameters required to operate the Servomotor are set in this example. Default settings are used for the PCU and Servo Drive parameters that are not set.



A Programming Console is used in this operation example without using a ladder program and with the PLC in PROGRAM mode to manually perform the settings and execute the start commands that are required to operate the Servomotor. The Programming Console is used to set the required data for direct operation and then turn ON the RELATIVE MOVEMENT Bit to operate the motor.

2-2-2 System Configuration and Wiring

The following system configuration is used. In this example, only the motor is operated, without using a mechanical system. The unit number of the PCU is 0, and the station address of the MECHATROLINK-II Application Module is 1.



The devices used in this configuration diagram example are as follows:

Device	Model
CPU Unit	CJ1H-CPU67H
Power Supply Unit	CJ1W-PA202
Position Control Unit	CJ1W-NCF71
Programming Console	C200H-PRO27
Programming Console Connecting Cable	CS1W-CN224 (2 m)
Servo Drive	R88D-WT01HL
Servomotor	R88M-W10030L
Servomotor Encoder Cable	R88A-CRWA003C (3 m)
Servomotor Power Cable	R88A-CAWA003S (3 m)
MECHATROLINK-II Application Module	JUSP-NS115 (Yaskawa)
MECHATROLINK-II Connection Cable	JEPMC-W6003-01 (Yaskawa) (1 m)
MECHATROLINK-II Terminator	JEPMC-W6022 (Yaskawa)

Each of the above devices is in its factory-shipped condition.

Setting the PCU Unit Number

Set the unit number using the rotary switch on the front of the PCU.

Unit number: 0

Setting the Station Address of the MECHATROLINK-II Application Module

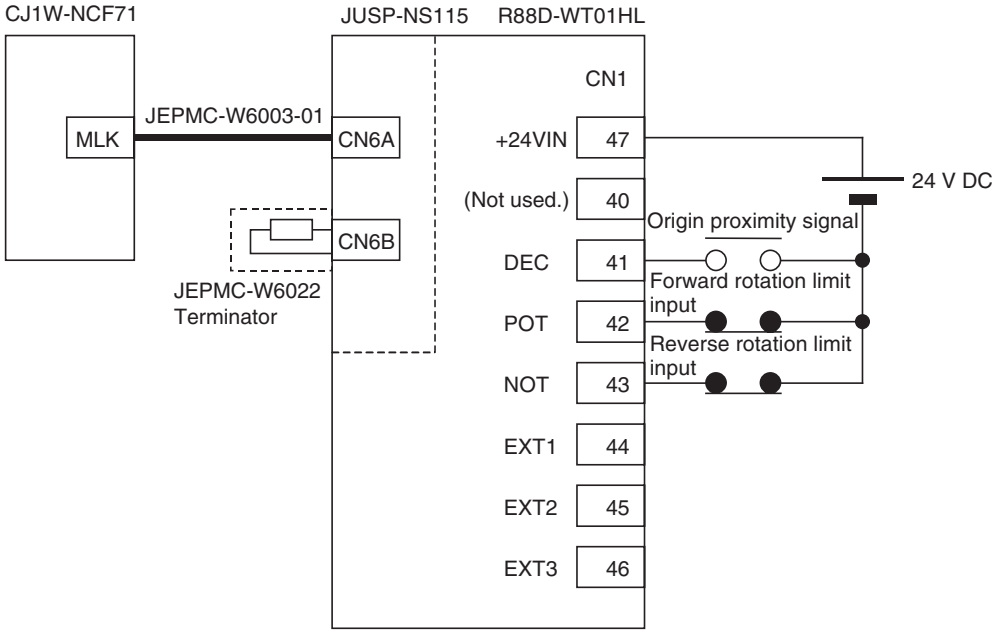
Set the station address of the MECHATROLINK-II Application Module using the rotary switch (SW1) on the Module. Use the default settings for the DIP switch (SW2).

SW1: 1

SW2: Default settings (pin 1: ON; pin 2: ON; pin 3: OFF; pin 4: OFF)

Wiring

Wire the Units as shown in the following diagram.



The Servo Drive's CN1 input signals depend on the input signal allocations, which are set in this operation example. Of these allocated input signals, the forward drive prohibit input (forward rotation limit input) and reverse drive prohibit input (reverse rotation limit input) are used as N.C. contacts. Therefore, connect them so that they are normally ON. The origin proximity signal and external latch inputs 1 to 3 are not used in this operation example and therefore do not need to be wired.

The above diagram shows the wiring for the PCU, Servo Drive, MECHATROLINK-II Application Module, and external control input signals at the Servo Drive. Refer to each of the CPU Unit and Servo Drive operation manuals for details on wiring the CPU Unit and Servo Drive power supply and connecting the Servo Drive and Servomotor.

2-2-3 Setting the PCU

Creating I/O Tables

Turn ON the power to the PLC and create the I/O tables. Refer to the *CJ Series PLC Operation Manual* for details on creating I/O tables.

Setting Common Parameters

Set the Common Parameters of the PCU. The minimum required Common Parameters that must be set are as follows:

- Axis Operating Output Memory Area designation
- Axis Operating Input Memory Area designation
- Scan list setting (information registered for axes connected to MECHATROLINK communications)

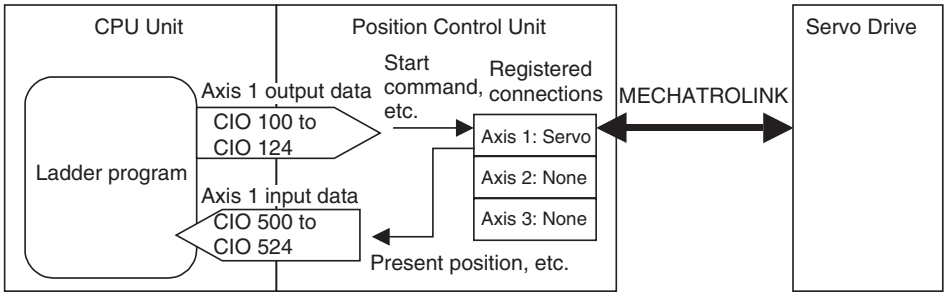
Common Parameters are transferred to the PCU using the WRITE DATA Bit in the Common Operating Memory Area. D01000 to D01011 are used for data to be transferred.

Common Parameters Set in the PCU

The following settings are made in D01000 to D01011 as the Common Parameters to be set in the PCU. Refer to the following table for setting details.

DM word	Set value	Common Parameter	Details
D01000	00B0 hex	Axis Operating Output Memory Areas	Set the beginning word of the Axis Operating Output Memory Areas to CIO 100. Axis 1 output words: CIO 100 to CIO 124
D01001	0064 hex	Beginning word of Axis Operating Output Memory Areas	
D01002	00B0 hex	Axis Operating Input Memory Areas	Set the beginning word of the Axis Operating Input Memory Area to CIO 500. Axis 1 input words: CIO 500 to CIO 524
D01003	01F4 hex	Beginning word of Axis Operating Input Memory Areas	
D01004	0040 hex	Scan list setting (axes 1 and 2)	Allocate axis 1 of the PCU to the Servo Drive.
D01005 to D01011	Set all words to 0000 hex.	Scan list setting (axes 3 to 16)	

The above settings enable the Servo Drive connected to MECHATROLINK to be controlled from the ladder program through the I/O words that are allocated as shown in the following diagram.

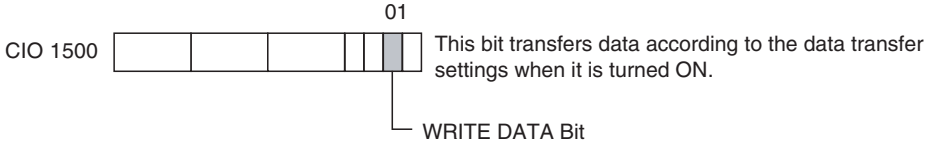


Writing Common Parameters to the PCU

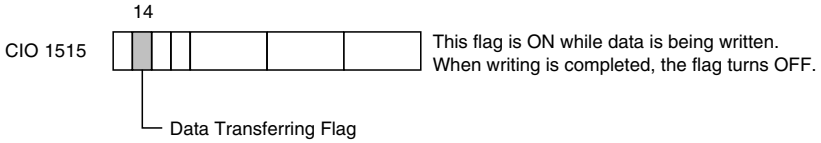
The Common Parameter settings in D01000 to D01011 are written to the PCU. Make the settings for transferring data to the PCU's Common Operating Memory Area as shown below.

Word	Set value	Data transfer setting name	Details
CIO 1506	000C hex	Number of write words	Number of write words: 0C hex = 12 decimal
CIO 1507	0082 hex	Write source area	Beginning word of write data: D01000
CIO 1508	03E8 hex	Write source word	
CIO 1509	1838 hex	Write destination address	Write destination address in PCU: 1838 hex = Beginning word of Common Parameter Area

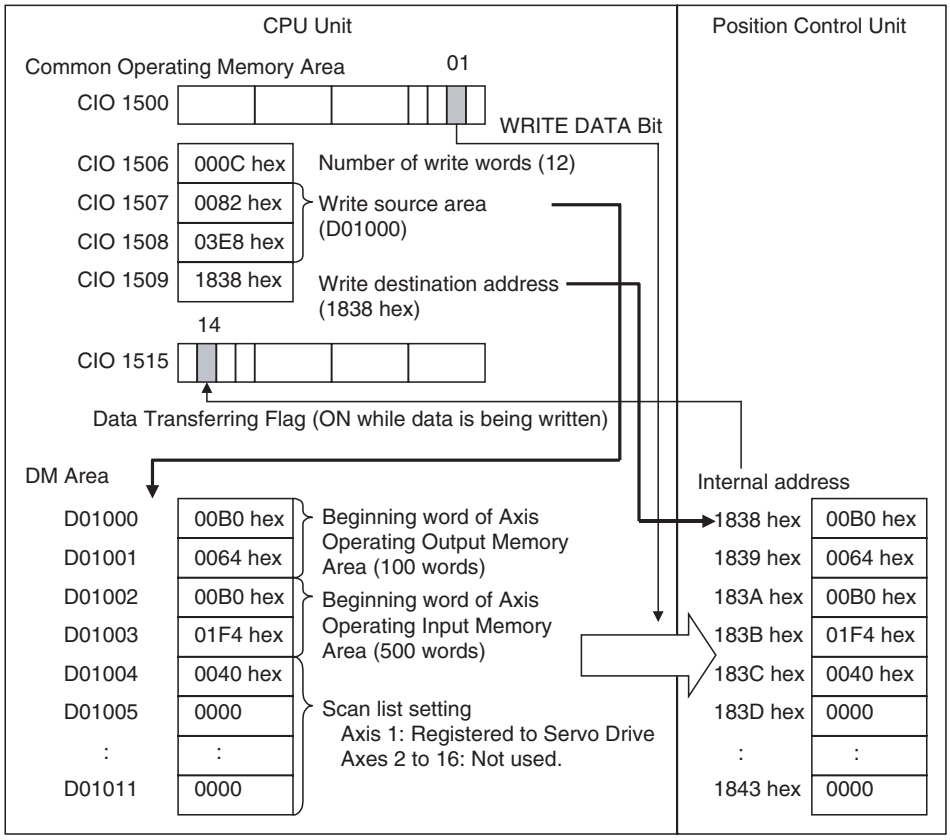
Data is written to the PCU by turning ON the WRITE DATA Bit in the Common Operating Memory Area. For the PCU with unit number 0, the WRITE DATA Bit is allocated in CIO 150001. Turn ON this bit using the Programming Console.



While data is being written to the PCU, the Data Transferring Flag in the Common Operating Memory Area turns ON. When data has finished being written, the Data Transferring Flag turns OFF. For the PCU with unit number 0, the Data Transferring Flag is allocated in CIO 151514.


14
CIO 1515
This flag is ON while data is being written.
When writing is completed, the flag turns OFF.
Data Transferring Flag

The following diagram shows the operation for writing data to the PCU.



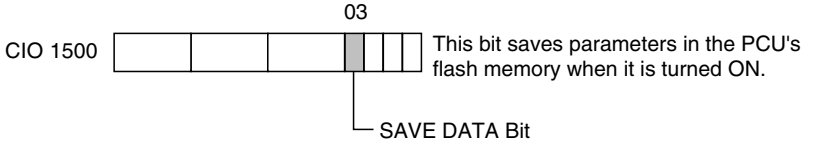
Setting Axis Parameters

In this operation example, the PCU's default settings are used for each axis parameter, so they do not need to be transferred to the PCU.

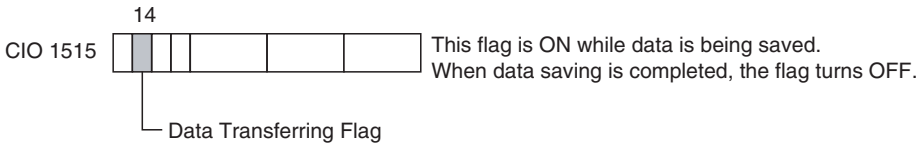
Saving PCU Settings

The Common Parameters are saved in the PCU's flash memory.

Data is saved to the PCU's flash memory by turning ON the SAVE DATA Bit in the Common Operating Memory Area. For the PCU with unit number 0, the SAVE DATA Bit is allocated in CIO 150003. Turn ON this bit using the Programming Console.



While data is being saved to flash memory, the Data Transferring Flag in the Common Operating Memory Area turns ON. When data has finished being saved, the Data Transferring Flag turns OFF. For the PCU with unit number 0, the Data Transferring Flag is allocated in CIO 151514.


14
CIO 1515
This flag is ON while data is being saved.
When data saving is completed, the flag turns OFF.
Data Transferring Flag

Restarting the PCU

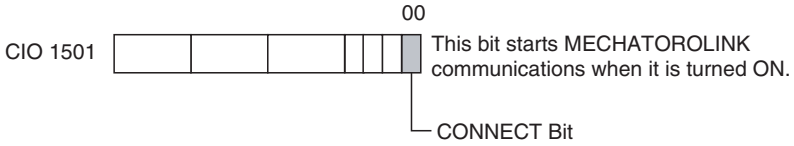
After the PCU settings have been saved, restart the PCU to enable the settings. Either cycle the power to the CPU Unit, or restart the PCU. For the PCU with unit number 0, the Restart Bit is allocated in A50100.

Note Do not turn OFF the power to the PLC or restart the PCU while data is being saved to the PCU's flash memory. Doing so may corrupt the PCU's memory. Always make sure that the Data Transferring Flag is OFF before turning OFF the power to the CPU Unit or restarting the PCU.

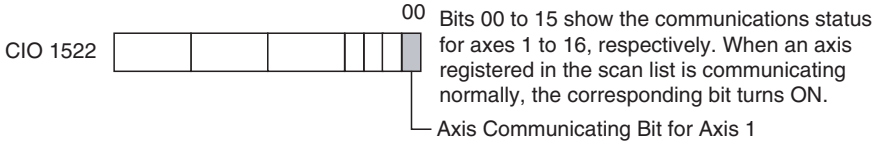
2-2-4 Starting MECHATROLINK Communications

Communications are started with the Servo Drive connected to MECHATROLINK based on the Common Parameter settings in the PCU.

MECHATROLINK communications are started by turning ON the CONNECT Bit in the Common Operating Memory Area. For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Turn ON this bit using the Programming Console.



When connections are established, the PCU starts communications with the MECHATROLINK devices (Servo Drives) registered in the scan list set in the Common Parameters. When communications with the registered device are normal, the corresponding bits for the axes in the Axis Communications Status of the Common Operating Memory Area are turned ON. For the PCU with unit number 0, the Axis Communications Status is allocated in the bits of CIO 1522.


00
CIO 1522
Bits 00 to 15 show the communications status
for axes 1 to 16, respectively. When an axis
registered in the scan list is communicating
normally, the corresponding bit turns ON.
Axis Communicating Bit for Axis 1

When communications with the registered devices are not normal, the corresponding bits for the axes in the Axis Communications Status bits of the Common Operating Memory Area are not turned ON and an MLK initialization error (Unit error code 0020 hex) occurs in the PCU. Any axis errors that occur can be checked using the Axis Error Flags and error codes in the Axis Operating Memory Areas.

The Connection Status Flag in the Common Operating Memory Area will turn ON at the start of communications when the CONNECT Bit turns ON, regardless of whether communications with all registered devices are normal.

In this operation example, if MECHATROLINK communications are started normally, the status of each flag is as follows:

Connection status (CIO 151615): 1 (Connection established)

Axis communications status (CIO 1522): 0001 (bit 00 = Communications established with axis 1)

Unit Error Flag (CIO 151512): 0 (No error)

Unit error code (CIO 1521): 0000 (No error)

Axis Error Flag for axis 1 (CIO 50012): 0 (No error) (See note.)

Axis error code for axis 1 (CIO 504): 0000 (No error) (See note.)

Note The Axis Operating Memory Area for axis 1 depends on the Axis Operating Input Memory Area settings in the Common Parameters.

2-2-5 Setting Servo Parameters

The Servo Parameters are set in the connected Servo Drive. The following table shows an example of settings for the Servo Drive's external input signal allocations (input signal selection).

Input terminal (CN1)	Input signal name	Setting	Servo Drive default setting
40	---	Not used	RUN (RUN command input)
41	DEC	Origin return deceleration limit switch (origin proximity input signal)	MING (gain reduction input)
42	POT	Forward drive prohibit input (forward rotation limit input signal)	Not allocated.
43	NOT	Reverse drive prohibit input (reverse rotation limit input signal)	Not allocated.
44	EXT1	External latch signal 1 (external interrupt input signal 1)	RESET (alarm reset input)
45	EXT2	External latch signal 2 (external interrupt input signal 2)	PCL (forward rotation current limit input)
46	EXT3	External latch signal 3 (external interrupt input signal 3)	NCL (reverse rotation current limit input)

These settings are standard for input signals when an R88D-WT□ Servo Drive and JUSP-NS115 MECHATROLINK-II Application Module are used together.

Transferring Servo Parameters

Servo Parameters are transferred to the Servo Drive via the PCU using the SAVE SERVO PARAMETER Bits in the PCU's Axis Operating Output Memory Areas. The Servo Parameters are transferred one at a time. The following three parameters must be set as shown below to allocate the above input signals.

Parameter No.	Parameter name	Set value
Pn50A	Input signal selection 1	2881
Pn50B	Input signal selection 2	8883
Pn511	Input signal selection 5	6541

Preparing Servo Parameters to Be Set in the Servo Drive

The settings for the parameter number, parameter size, and write data are set in the Axis Operating Output Memory Area as Servo Parameters to be set in the Servo Drive. In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the setting words for the Servo Parameters for axis 1 are allocated as follows:

Word	Details
CIO 117	Servo Parameter No.
CIO 118	Parameter size (Unit: bytes)
CIO 119	Write data (rightmost word)
CIO 120	Write data (leftmost word)

Writing Servo Parameters to the Servo Drive

The Servo Parameter settings in CIO 117 to CIO 120 are written to the Servo Drive. In this example, to transfer three Servo Parameters, execute the operation to write to the Servo Drive three times.

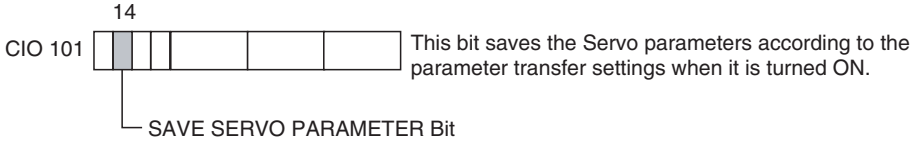
Writing the Pn50A Set Value

To write the Pn50A settings, first make the settings for transferring Servo Parameters to the PCU's Axis Operating Output Memory Areas as shown below.

Word	Set value	Parameter transfer setting	Details
CIO 117	050A hex	Servo Parameter No.	Write Servo Parameter No.: Pn50A
CIO 118	0002	Parameter size	Write parameter size: 2 (bytes)
CIO 119	2881 hex	Write data (rightmost word)	Write Servo Parameter set value: 2881
CIO 120	---	Write data (leftmost word)	Parameter size is 2 bytes (1 word, so this is not used.) The set value is ignored.

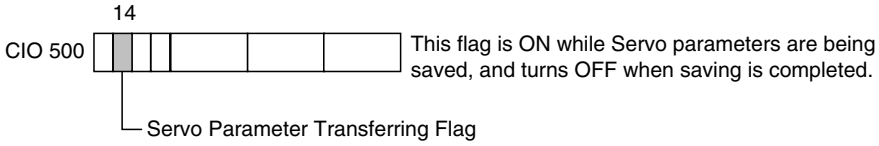
In this example, to keep the Servo Parameters even if the Servo Drive power is turned OFF, the Servo Parameters are saved in the non-volatile memory (flash memory) in the Servo Drive. Servo Parameters are written from the PCU to the non-volatile memory (flash memory) of the Servo Drive by turning ON the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SAVE SERVO PARAMETER Bit for axis 1 is allocated in CIO 10114. Turn ON this bit using the Programming Console.


14
CIO 101
This bit saves the Servo parameters according to the parameter transfer settings when it is turned ON.
SAVE SERVO PARAMETER Bit

While Servo Parameters are being saved to the Servo Drive, the Servo Parameter Transferring Flag in the Axis Operating Input Memory Area turns ON. When the Servo Parameters have finished being saved, the Servo Parameter Transferring Flag turns OFF.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the Servo Parameter Transferring Flag for axis 1 is allocated in CIO 50014.


14
CIO 500
This flag is ON while Servo parameters are being saved, and turns OFF when saving is completed.
Servo Parameter Transferring Flag

The set values for Pn50B and Pn511 are written in the same way, i.e., by changing the details of the Servo Parameters to be transferred and turning ON the WRITE DATA Bit.

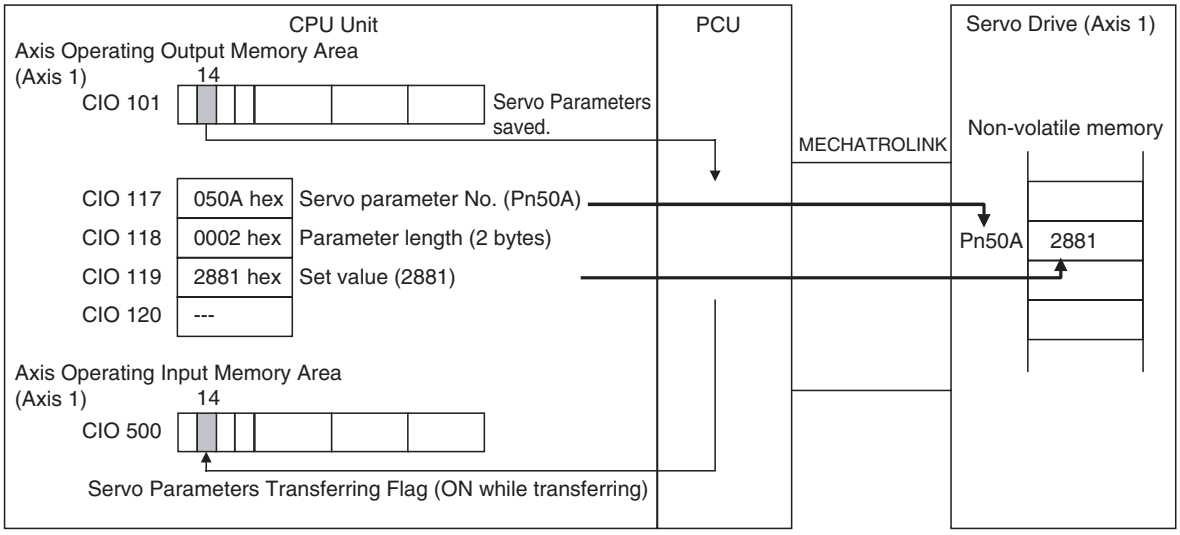
Writing the Pn50B Set Value

Word	Set value	Parameter transfer setting	Details
CIO 117	050B hex	Servo Parameter No.	Write Servo Parameter No.: Pn50B
CIO 118	0002 hex	Parameter size	Write parameter size: 2 (bytes)
CIO 119	8883 hex	Write data (rightmost word)	Write Servo Parameter setting: 8883
CIO 120	---	Write data (leftmost word)	Parameter size is two bytes (one word, so this is not used.) The setting is ignored.

Writing the Pn511 Setting

Word	Set value	Parameter transfer setting	Details
CIO 117	0511 hex	Servo Parameter No.	Write Servo Parameter No.: Pn511
CIO 118	0002 hex	Parameter size	Write parameter size: 2 (bytes)
CIO 119	6541 hex	Write data (rightmost word)	Write Servo Parameter setting: 6541
CIO 120	---	Write data (leftmost word)	Parameter size is two bytes (i.e., one word, so this is not used.) The setting is ignored.

The following diagram shows the operation used to transfer parameters to the Servo Drive.

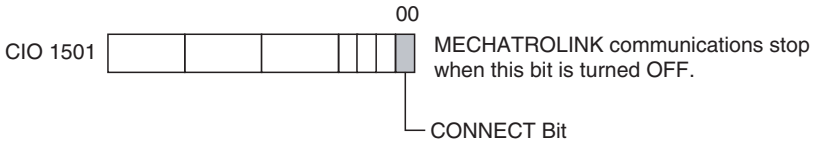


Ending MECHATROLINK Communications

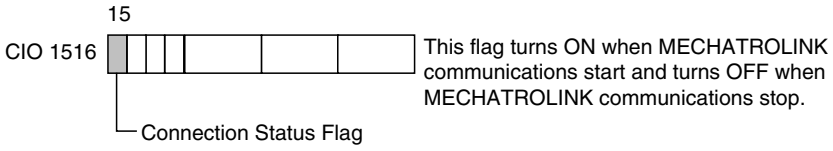
The Servo Parameters written to the Servo Drive consist of online and offline parameters. Online parameters are enabled as soon as they are written, whereas offline parameters are not.

The input signal selection parameters set here are offline parameters that are enabled by cycling the power to the Servo Drive or executing the device setup operation. In this example, the Servo Drive power is cycled. First, stop MECHATROLINK communications before turning OFF the power supply to the Servo Drive.

MECHATROLINK communications are stopped by turning OFF the CONNECT Bit in the Common Operating Memory Area. For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Use the Programming Console to turn OFF this bit, which was turned ON at the start of MECHATROLINK communications.



When MECHATROLINK communications stop, the Connection Status Flag in the Common Operating Memory Area turns OFF. For the PCU with unit number 0, the Connection Status Flag is allocated in CIO 151615.


15
CIO 1516
This flag turns ON when MECHATROLINK communications start and turns OFF when MECHATROLINK communications stop.
Connection Status Flag

Turning the Servo Drive Power OFF and ON Again

After writing Servo Parameters, and when MECHATROLINK communications have stopped, enable the Servo Parameters by cycling the power to the Servo Drive. This procedure completes settings for the PCU and Servo Drive. Unless changes in installation, wiring, or parameter settings are required, the above operation does not need to be performed a second time.

2-2-6 Operating the Servomotor from the PCU

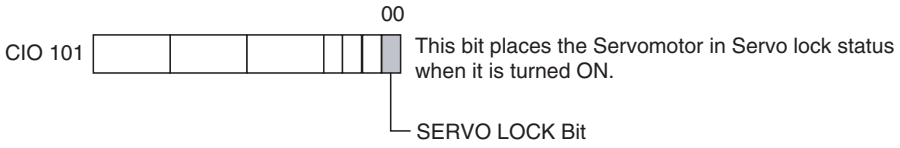
Starting MECHATROLINK Communications

Perform the operations described in *2-2-4 Starting MECHATROLINK Communications* and then start communications with the Servo Drive connected to MECHATROLINK.

Servo Lock

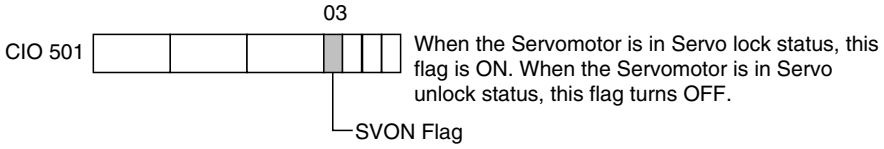
The servo lock of the Servomotor connected to MECHATROLINK can be set by turning ON the SERVO LOCK Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SERVO LOCK Bit for axis 1 is allocated in CIO 10100. Turn ON this bit using the Programming Console.



When the servo lock operation is performed, the Servomotor is placed in servo lock status. The SVON (Servo ON) Flag indicating servo status in the Axis Operating Input Memory Area turns ON when an R88D-WT□ Servo Drive and JUSP-NS115 MECHATROLINK-II Application Module are used together.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the SVON Flag for axis 1 is allocated in CIO 50103.


03
CIO 501
When the Servomotor is in Servo lock status, this flag is ON. When the Servomotor is in Servo unlock status, this flag turns OFF.
SVON Flag

When the servo lock is no longer required, turn OFF the corresponding SERVO LOCK Bit in the Axis Operating Output Memory Area.

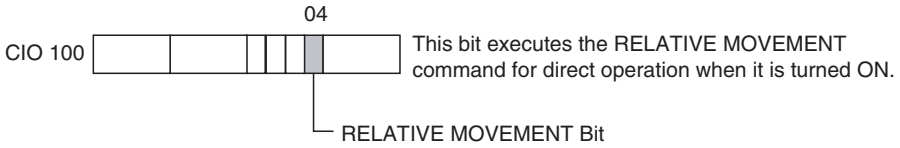
Positioning Using the Direct Operation RELATIVE MOVEMENT Command

Positioning can be performed for axis 1 using the RELATIVE MOVEMENT command for direct operation. The RELATIVE MOVEMENT command for direct operation sends information on the target position and target speed to the Axis Operating Output Memory Area when the RELATIVE MOVEMENT Bit turns ON.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the target position and target speed are set as follows:

Word	Set value	Parameter transfer setting	Details
CIO 102	A120 hex	Position command value (rightmost word)	Target position: 0007 A120 hex = 500,000 pulses
CIO 103	0007 hex	Position command value (leftmost word)	
CIO 104	86A0 hex	Speed command value (rightmost word)	Target speed: 0001 86A0 hex = 100,000 pulses/s
CIO 105	0001 hex	Speed command value (leftmost word)	

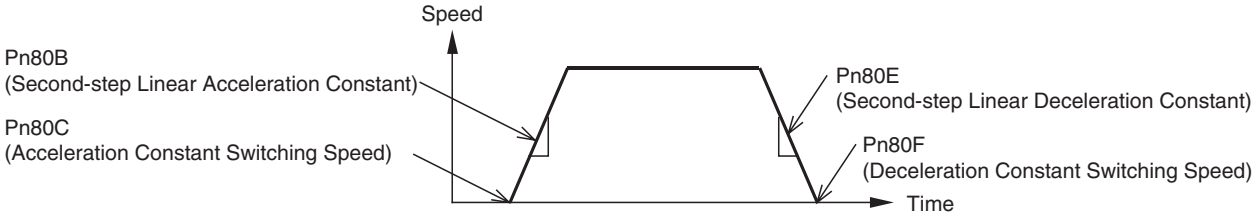
The RELATIVE MOVEMENT Bit for axis 1 is allocated in CIO 10004. Therefore, turn this bit ON using the Programming Console.


04
CIO 100
This bit executes the RELATIVE MOVEMENT command for direct operation when it is turned ON.
RELATIVE MOVEMENT Bit

The Servomotor starts rotating up to the target speed of 100,000 pulses/s and stops at 500,000 pulses. The acceleration/deceleration speed depends on the Servo Parameters set for the Servo Drive. When a W-series Servo Drive and the JUSP-NS115 are used together, the acceleration and deceleration speeds are set in the Servo Parameters as follows:

Parameter No.	Parameter name	Default	Unit	Setting in this example
Pn80A	First-step linear acceleration constant	100	10,000 command units/s^2	Not used.
Pn80B	Second-step linear acceleration constant	100	10,000 command units/s^2	1,000,000 pulses/s^2
Pn80C	Acceleration constant switching speed	0	100 command units/s	Default settings used.
Pn80D	First-step linear deceleration constant	100	10,000 command units/s^2	Not used.
Pn80E	Second-step linear deceleration constant	100	10,000 command units/s^2	1,000,000 pulses/s^2
Pn80F	Deceleration constant switching speed	0	100 command units/s	Default settings used.

In this operation example, the default settings are used for the acceleration/deceleration constants. With the default settings, the acceleration/deceleration movement uses a linear acceleration/deceleration waveform, and the slope of the acceleration and deceleration is 1,000,000 pulses/s^2.The target speed is 100,000 pulses/s, so after starting, the motor accelerates up to the target speed in 0.1 s, and decelerates to a stop from the target speed in 0.1 s.



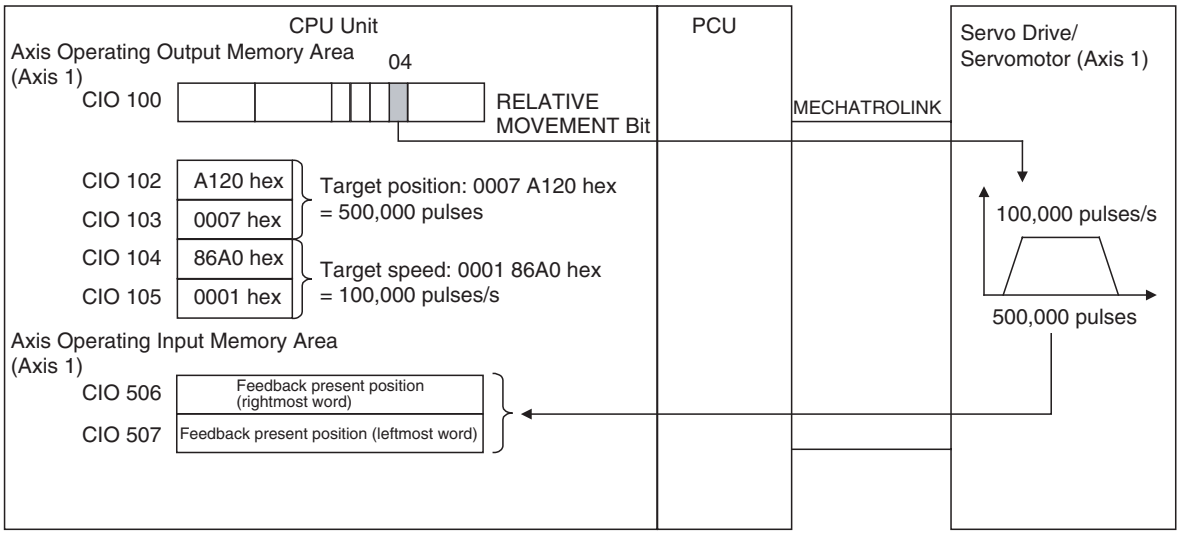
In this operation example, the acceleration/deceleration constant switching speed is 0. Therefore, from startup, the motor accelerates according to the Second-step Linear Acceleration Constant and decelerates using the Second-step Linear Deceleration Constant until stopping. The First-step Acceleration/Deceleration Constants are not used.

The present position of each axis can be monitored in the Axis Operating Input Memory Areas.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the present position (feedback present position) for axis 1 is allocated in CIO 506 and CIO 507.

CIO 506	Feedback present position (rightmost word)
CIO 507	Feedback present position (leftmost word)

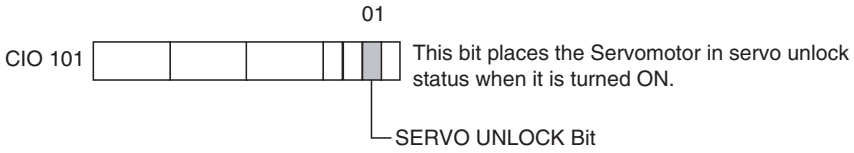
The following diagram shows the operation for the RELATIVE MOVEMENT command.



Servo Unlock

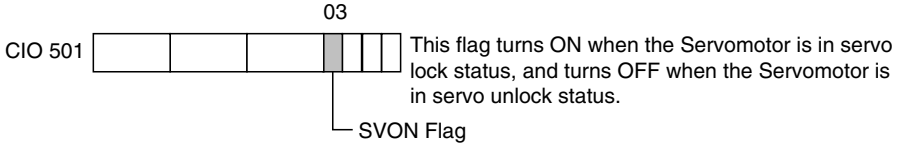
The Servomotor connected to MECHATROLINK can be set to servo unlock status by turning ON the SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SERVO UNLOCK Bit for axis 1 is allocated in CIO 10101. Turn ON this bit using the Programming Console.



When the servo unlock operation is performed, the Servomotor is placed in servo unlock status. The SVON (Servo ON) Flag indicating servo status in the Axis Operating Memory Areas turns OFF when using an R88D-WT□ Servo Drive with a JUSP-NS115 MECHATROLINK-II Application Module.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the SVON Flag for axis 1 is allocated in CIO 50103.

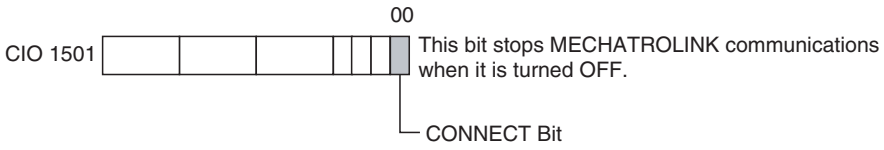

03
CIO 501
This flag turns ON when the Servomotor is in servo
lock status, and turns OFF when the Servomotor is
in servo unlock status.
SVON Flag

When the servo unlock status is no longer required, turn OFF the corresponding SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

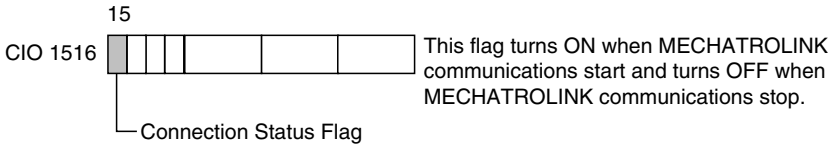
Stopping MECHATROLINK Communications

Always stop MECHATROLINK communications before turning OFF the power supply to the Servo Drive. MECHATROLINK communications are stopped by turning OFF the CONNECT Bit in the Common Operating Memory Area.

For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Use the Programming Console to turn OFF this bit, which was turned ON at the start of MECHATROLINK communications.



When MECHATROLINK communications stop, the Connection Status Flag in the Common Operating Memory Area turns OFF. For the PCU with unit number 0, the Connection Status Flag is allocated in CIO 151615.


15
CIO 1516
This flag turns ON when MECHATROLINK communications start and turns OFF when MECHATROLINK communications stop.
Connection Status Flag

This completes the operations example for operating the Servomotor using the RELATIVE MOVEMENT command for direct operation. In this operation example, the commands are sent manually from the Programming Console, but the basic operation flow is the same when sequences are programmed into the ladder program. Other functions are also used in the same way by changing the parameter settings and manipulating bits.

SECTION 3
Installation and Wiring

This section provides information on nomenclature and functions, and describes the procedures required for wiring and installation. Information on the MECHATROLINK-II Application Module is also provided.

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3-1-1 Nomenclature 32
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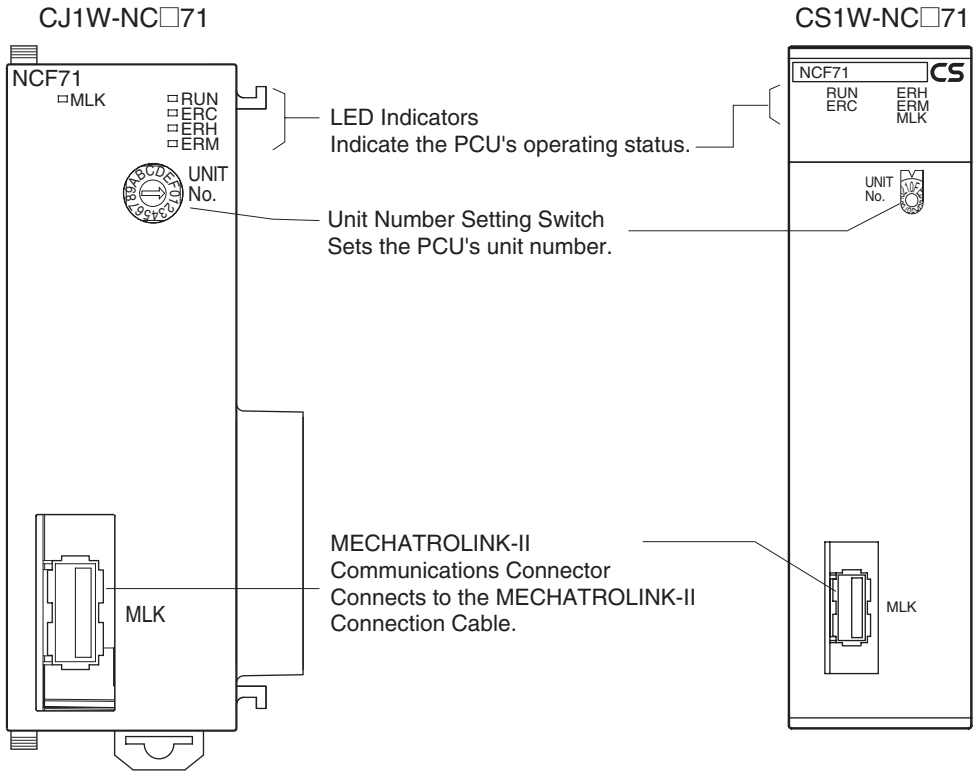
3-1 Nomenclature and Functions

3-1-1 Nomenclature



LED Indicators

LED	Name	Color	Status	Details
RUN	Run	Green	Lit	The PCU is operating normally.
			Not lit	Other condition
ERC	Unit Error	Red	Lit	A fatal error has occurred in the PCU and operation cannot continue.
			Flashing	A non-fatal error has occurred in the PCU and operation can continue.
			Not lit	Other condition
ERH	CPU Unit Error	Red	Lit	An error has occurred in the PLC.
			Not lit	Other condition
ERM	MECHATROLINK Device Error	Red	Lit	An error has occurred in MECHATROLINK communications.
			Flashing	An error has occurred in a connected MECHATROLINK device.
			Not lit	Other condition
MLK	MECHATROLINK Communications Status	Yellow	Lit	MECHATROLINK communications in progress
			Not lit	MECHATROLINK communications stopped

For details on errors, refer to *SECTION 12 Troubleshooting*.

Unit Number Setting Switch (UNIT No.)

Set the unit number using the rotary switch on the front of the PCU. The PCU's unit number is a CPU Bus Unit unit number.

CJ1W-NC□71 CS1W-NC□71

Setting range: 0 to F (Unit numbers 0 to 15)

Note The factory default setting is 0.

The unit number setting determines which words are allocated to the PCU in the CPU Bus Unit Area within the CPU Unit's CIO Area.

The PCU uses this allocated area as the “Common Operating Memory Area.” For details, refer to *4-6 Common Operating Memory Area*.

Unit number	Allocated words	Unit number	Allocated words
0	1500 to 1524	8	1700 to 1724
1	1525 to 1549	9	1725 to 1749
2	1550 to 1574	10	1750 to 1774
3	1575 to 1599	11	1775 to 1799
4	1600 to 1624	12	1800 to 1824
5	1625 to 1649	13	1825 to 1849
6	1650 to 1674	14	1850 to 1874
7	1675 to 1699	15	1875 to 1899

Note Always turn OFF the power supply before changing the Unit Number Setting Switch's setting.

MECHATROLINK-II Communications Connector

This connector connects the PCU with MECHATROLINK devices through the special MECHATROLINK-II Connection Cable.

For details on MECHATROLINK-II Connection Cable models and configuration, refer to *3-4-1 MECHATROLINK-II Communications Wiring*.

3-1-2 MECHATROLINK-II Application Module for W-series Servo Drives

The following MECHATROLINK-II Application Module must be mounted to a an R88D-WT□ W-series Servo Drive without built-in MECHATROLINK-II communications to enable connection to the PCU through MECHATROLINK-II.

Name	Model number	Manufacturer
MECHATROLINK-II Application Module	JUSP-NS115	Yaskawa Electric Corporation

When a MECHATROLINK-II Application Module must be mounted to a W-series Servo Drive, use the following device versions.

Device	Compatible versions
W-series Servo Drive	Ver. 39 or later
MECHATROLINK-II Application Module	VER. □□□03 or later

The versions of both the W-series Servo Drive and MECHATROLINK-II Application Module can be found on the nameplate on the side of each device. If an earlier version of the device is used, it will not function properly. Always use products with versions listed in the table above (or later versions).

Nomenclature

This section provides a basic description of the JUSP-NS115 MECHATROLINK-II Application Module's LED Indicators and Setting Switches.

For details, refer to the *JUSP-NS115 MECHATROLINK-II Application Module User's Manual*.

Note Refer to the user's manual for the Servo Drive for the nomenclature and functions of Servo Drives with Built-in MECHATROLINK-II Communications.

- G-series Servo Drives with Built-in MECHATROLINK-II Communications (R88D-GN□-ML2)
- W-series Servo Drives with Built-in MECHATROLINK-II Communications (R88D-WN□-ML2)
- SMARTSTEP Junior Servo Drives with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2)

LED Indicators

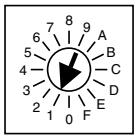
The LED Indicators show the operating status of the JUSP-NS115.

LED	Name	Color	Status	Details
A	Alarm Status	Red	Lit	An alarm occurred in the Servo Drive. (See note.)
			Not lit	Other condition
R	MECHATROLINK-II Communications Status	Green	Lit	MECHATROLINK communications in progress
			Not lit	MECHATROLINK communications stopped

Note The Alarm Status LED will also be lit when MECHATROLINK communications are not established with the PCU.

Station Address Setting Switch (SW1)

Set the Servo Drive's station address in conjunction with the MECHATROLINK-II communications setting on pin 3 of the Communications Setting DIP Switch (SW2).



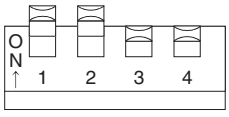
Setting Range: 0 to F (See the following table.)

Note The factory default setting is 1.

Pin 3 of SW2	SW1	Station address	Note
OFF	0	---	Cannot be used. Do not set.
	1 to F	1 to 15	---
ON	0	16	---
	1 to F	---	Cannot be used when connecting to the PCU. Do not set.

Communications Setting DIP Switch (SW2)

Sets the MECHATROLINK-II communications settings.



Pin	Function	Setting	Contents	Default setting	Note
1	Baud rate	OFF	4 Mbps	ON	Turn ON this pin (10 Mbps) when connecting to the PCU.
		ON	10 Mbps		
2	Transmission bytes	OFF	17 bytes	ON	Turn ON this pin (32 bytes) when connecting to the PCU.
		ON	32 bytes (See note.)		
3	Station address	OFF	1 to 15	OFF	See the explanation of SW1.
		ON	16 to 30		
4	Reserved by the system.	OFF	---	OFF	Leave this pin OFF.

Note (1) In some devices, the number of transmission bytes is expressed as "30 bytes," but the meaning is the same as this 32-byte setting.

(2) The MECHATROLINK-II Application Module can be ordered from OMRON with the following model number.

Name	Yaskawa Electric Co. model number	OMRON model number
MECHATROLINK-II Application Module	JUSP-NS115	FNY-NS115

3-2 Installing the Position Control Unit

3-2-1 System Configuration Precautions

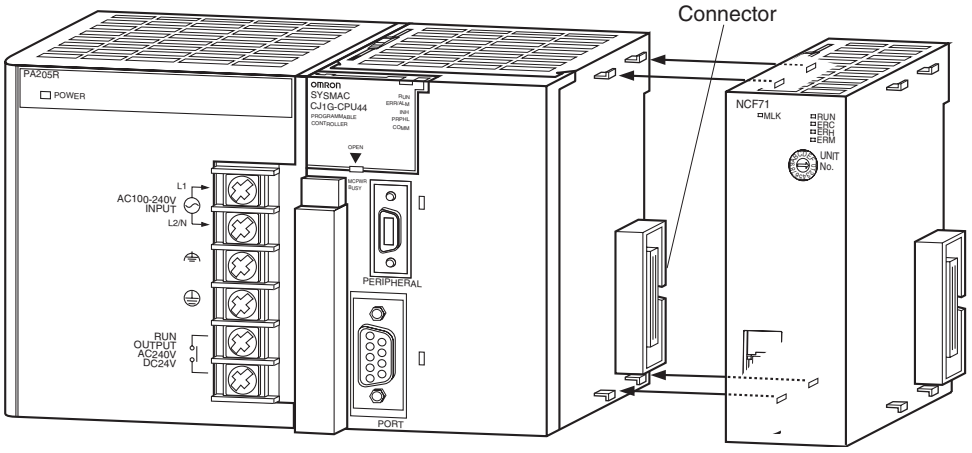
- The I/O words allocated to the PCU as a CPU Bus Unit are not determined by the Unit's mounting order, but by the unit number set on the Unit Number Setting Switch on the front of the Unit.
- The PCU can be mounted in either the CPU Rack or an Expansion Rack (only up to 10 Units per Rack for a CJ-series PLC) and up to 16 Units can be controlled by one CPU Unit.
- The CS1W-NC□71 can be mounted to a CS1W-BC□□3 CPU Backplane or a CS1W-BI□□3 Expansion Backplane.

3-2-2 Unit Installation

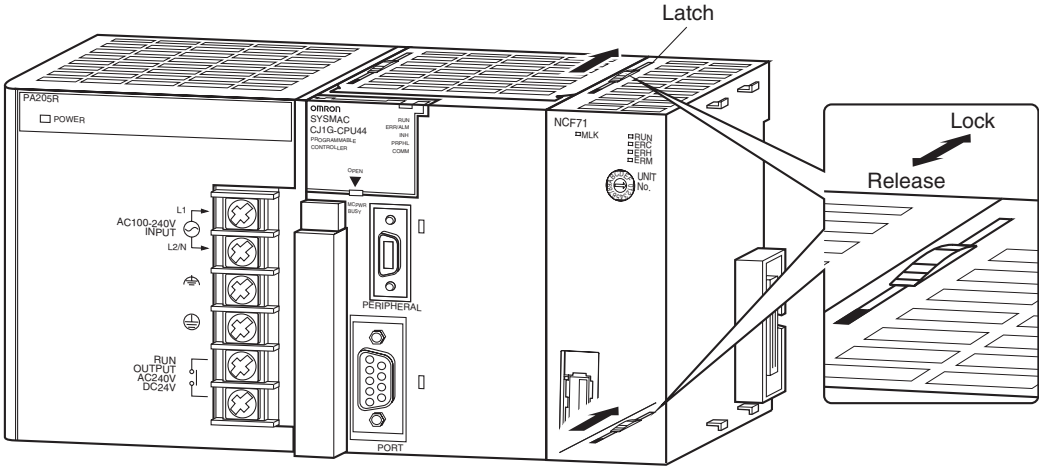
Use the following procedure to install the PCU.

CJ1W-NC□71

1,2,3... 1. Align the connectors correctly and mount the PCU.



2. Secure the PCU by sliding the yellow latches on the top and bottom until they click and lock.

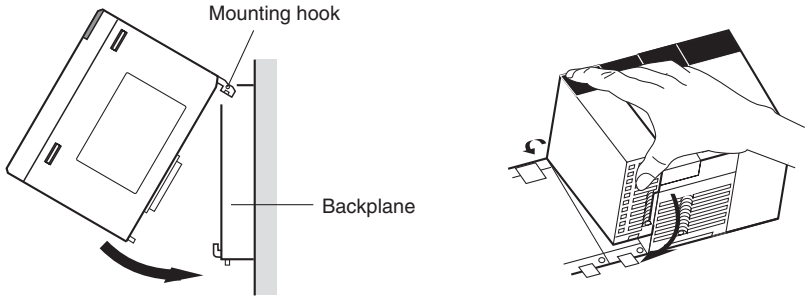


Note If the latches are not completely locked, the PCU may not function properly.

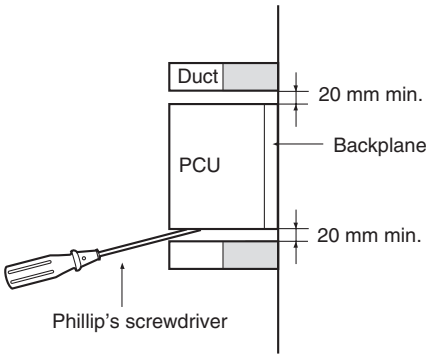
To remove the PCU, slide the latches in the “release” direction and remove the PCU.

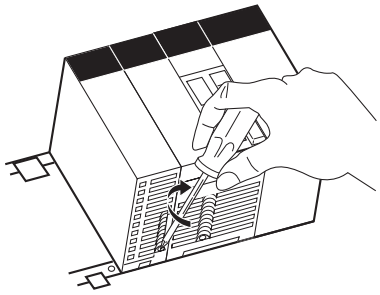
CS1W-NC□71

1,2,3... 1. Catch the hook on the top back of the PCU on the Backplane to mount the unit.



2. Insert the connector on the back of the CPU properly into the connector on the Backplane.

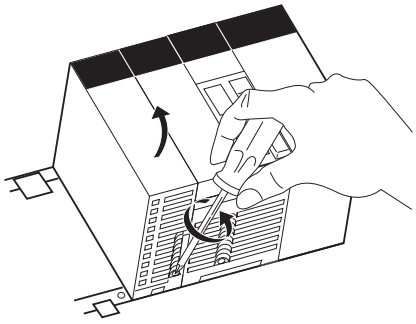




3. Tighten the screw on the bottom of the PCU using a Phillip's screwdriver. When mounting the PCU inside equipment, provide the minimum space indicated in the diagram to enable mounting/dismounting the PCU and to ensure proper ventilation.

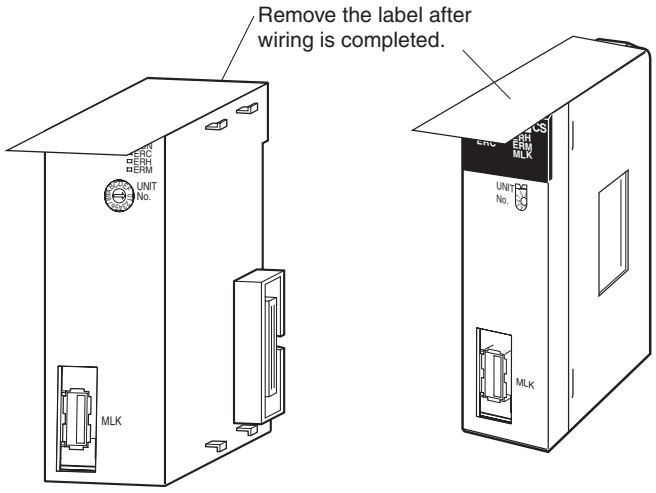
Note Always tighten the mounting screw on the bottom of the PCU to a torque of 0.4 N·m.

To remove the PCU, loosen the screw at the bottom of the PCU using a Phillip's screwdriver and then lift up on the bottom of the PCU.



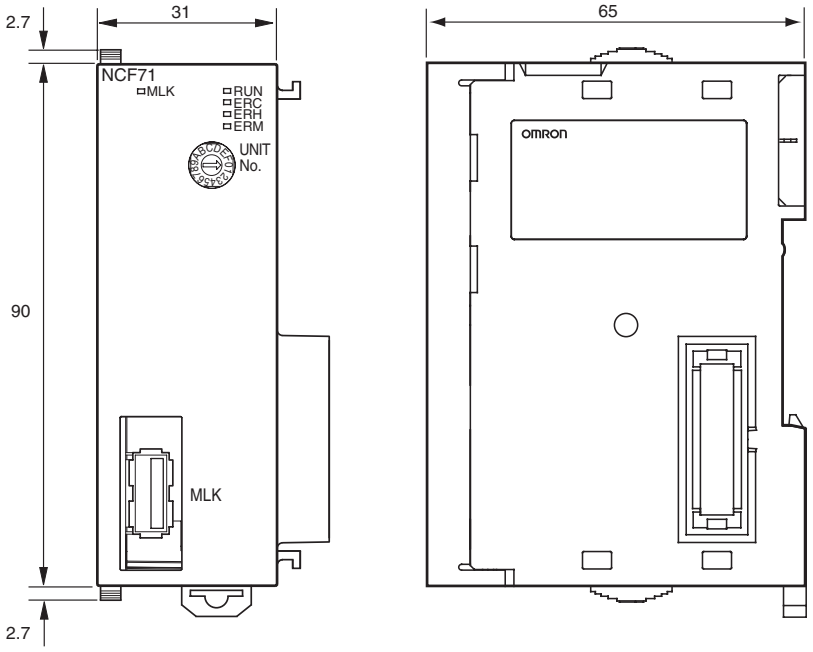
3-2-3 Installation Precautions

- Always turn OFF the CPU Unit's power supply before connecting or disconnecting cables or the Unit itself.
- To minimize the effects of noise, place I/O wiring in a separate duct from high-voltage lines and power lines.
- Wire strands may be scattered around during wiring, so leave the protective label on top of the PCU to prevent any wire strands from getting inside the PCU. Once the wiring has been completed, be sure to remove the label to allow ventilation.

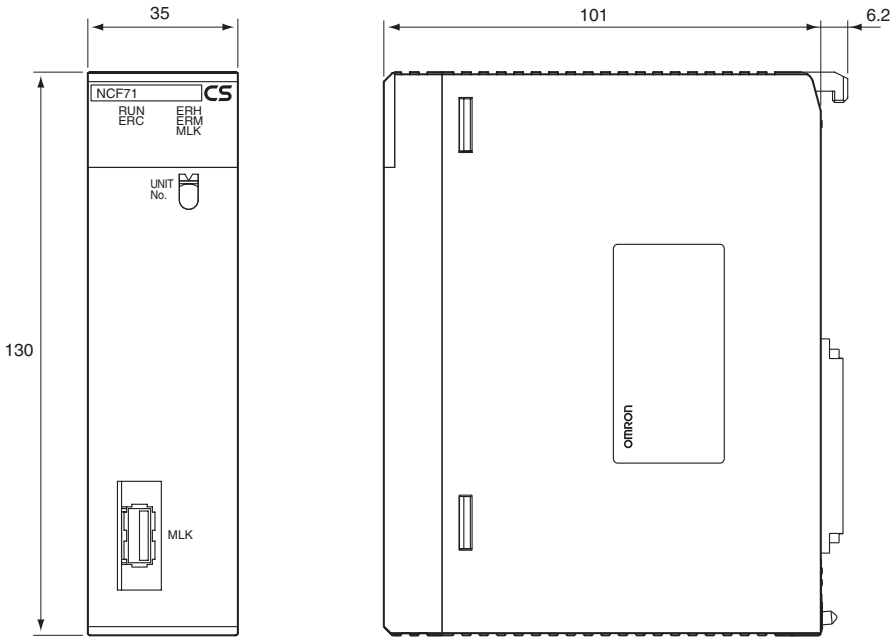


3-2-4 Dimensions

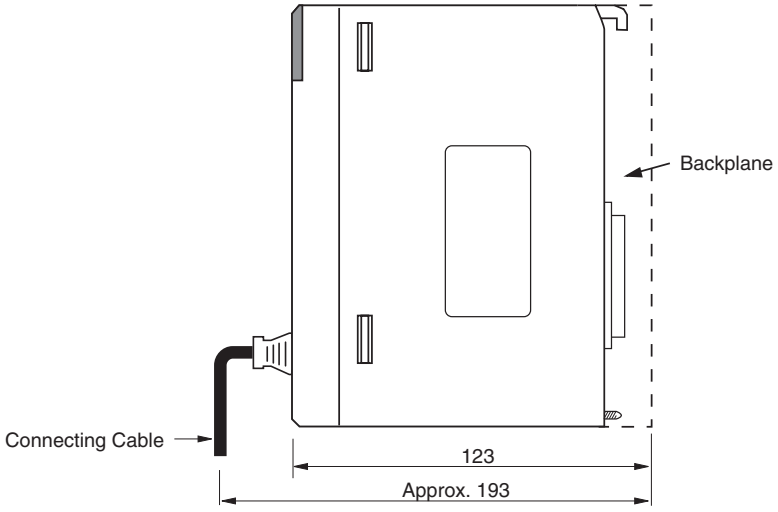
CJ1W-NC□71



CS1W-NC□71



Dimensions Mounted to Backplane



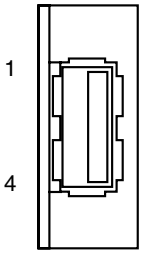
3-3 External I/O Circuits

This section describes the external I/O when a Position Control Unit is used with any of the following Servo Drives.

- G-series Servo Drives (R88D-GN□-ML2 with built-in MECHATROLINK-II communications)
- W-series Servo Drives (equipped with R88D-WT□ and JUSP-NS115)
- W-series Servo Drives (R88D-WN□-ML2 with built-in MECHATROLINK-II communications)
- SMARTSTEP Junior Servo Drives (R7D-ZN□-ML2 with built-in MECHATROLINK-II communications)

3-3-1 PCU I/O Signals

MECHATROLINK Connector (MLK)

Connector specifications	Explanation	
Name	MLK	MECHATROLINK-II connector
Connector used	USB connector	DUSB-ARA41-T11 (made by DDK) or equivalent
Applicable connector	USB connector	DUSB-APA41-B1-C50 (made by DDK), including shell
Pin arrangement		

Pin	Name	I/O	Description
1	(NC)	---	---
2	SRD–	I/O	Send/receive data –
3	SRD+	I/O	Send/receive data +
4	(NC)	---	---
Shell	Shield	---	Shield ground

3-3-2 G-series Servo Drive I/O Signals (R88D-GN□-ML2 with Built-in MECHATROLINK-II Communications)

This section describes the standard I/O signals used with a Position Control Unit when using a G-series Servo Drive with Built-in MECHATROLINK-II Communications.

Use the *OMNUC G Series AC Servomotors/Servo Drives with Built-in MECHATROLINK-II Communications User's Manual* (Cat. No. I566) together with this manual for information on I/O signals.

Terminal Arrangement of the Control I/O Connector (CN1)

When using G-series Servo Drives with built-in MECHATROLINK-II communications, the default control I/O signal allocations are the standard Servo Drive settings for using MECHATROLINK.

The following diagram shows the terminal arrangement of the Servo Drive's Control I/O Connector (CN1) when MECHATROLINK is being used with the Servo Drive's default settings.

This diagram shows only the I/O signals used when connecting to the PCU.

For details on the Servo Drive's standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

2	STOP	Emergency Stop Input
4	EXT2	External Latch Signal 2
6	IN1	External General-purpose Input 1
8	NCL	Reverse Torque Limit Input
10	---	*
12	---	*
14	---	*
16	ALMCOM	Alarm Output
18	---	*

1	+24VIN	12 to 24-VDC Power Supply Input
3	EXT3	External Latch Signal 3
5	EXT1	External Latch Signal 1
7	PCL	Forward Torque Limit Input
9	---	*
11	---	*
13	---	*
15	/ALM	Alarm Output
17	---	*

20	NOT	Reverse Drive Prohibit Input
22	IN0	External General-purpose Input 0
24	---	*
26	---	*
28	---	*
30	OUTM2 COM	General-purpose Output 2
32	OUTM3 COM	General-purpose Output 3
34	BAT	Backup Battery Input
36	OUTM1	General-purpose Output 1

19	POT	Forward Drive Prohibit Input
21	DEC	Origin Proximity Input
23	IN2	External General-purpose Input 2
25	---	*
27	---	*
29	OUTM2	General-purpose Output 2
31	OUTM3	General-purpose Output 3
33	BATCOM	Backup Battery Input
35	OUTM1COM	General-purpose Output 1

Note (1) Do not connect anything to unused pins (*).

(2) Inputs for pins 19 and 20 are determined by parameter settings. The diagram shows the default configuration.

CN1 Connector (36 Pin)

Name	Model	Manufacturer
Servo Drive Connector	52986-3679	Molex Japan
Cable Connector	10136-3000PE	Sumitomo 3M
Cable Case (Shell Kit)	10336-52A0-008	Sumitomo 3M

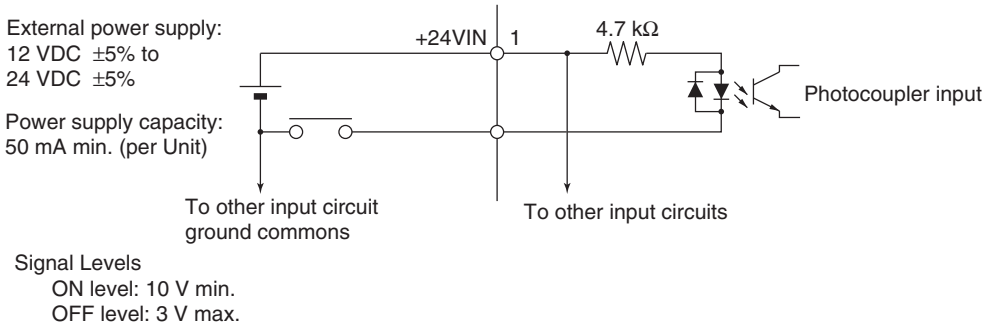
Control I/O Signals

The following table shows the names and functions of the Servo Drive's control I/O signals.

CN1 Control Input Signals

Pin No.	Symbol	Name	Function/Interface
1	+24VIN	12 to 24-VDC Power Supply Input	Power supply input terminal (12 to 24 VDC) for sequence inputs.
2	STOP	Emergency Stop Input	Input for emergency stop. When this signal is enabled and pin 1 is not connected to pin 2, an Emergency Stop Input error (alarm code 87) occurs. Set this signal to be enabled or disabled in the Emergency Stop Input Setting (Pn041). (Factory default: Enable)
3	EXT3	External Latch Signal 3	This external signal input latches the current value feedback pulse counter. The position data is obtained the moment the input is turned ON. Minimal signal width must be 1 ms or more.
4	EXT2	External Latch Signal 2	
5	EXT1	External Latch Signal 1	
6	IN1	External General-purpose Input 1	This input is used as external general-purpose input 1.
7	PCL	Forward Torque Limit Input	When the Torque Limit Selection (Pn003) is set to 3 or 5, this signal input selects the torque limit.
8	NCL	Reverse Torque Limit Input	
19 to 20	POT	Forward Drive Prohibit Input	Forward, reverse drive rotation overtravel Input. Pn004 chooses between enable and disable. Pn044 sets the function assignment for pins 19 and 20. Pn066 selects the operation.
	NOT	Reverse Drive Prohibit Input	
21	DEC	Origin Proximity Input	Connect the origin proximity input signal in the origin search operation. Pn042 changes the logic of the sensor.
22	IN0	External General-purpose Input 0	This input is used as external general-purpose input 0.
23	IN2	External General-purpose Input 2	This input is used as external general-purpose input 2.
11	---	Not used	Do not connect anything.
12	---	Not used	Do not connect anything.
13	---	Not used	Do not connect anything.
14	---	Not used	Do not connect anything.
9	---	Not used	Do not connect anything.
10	---	Not used	Do not connect anything.
27	---	Not used	Do not connect anything.
28	---	Not used	Do not connect anything.
34	BAT	Backup battery input	Connect a battery to these terminals as a backup when the absolute encoder is stopped. A cable with a battery is not required if a battery is connected to these terminals. (Backup voltage: 3.6 V)
33	BATCOM		
17	---	Not used	Do not connect anything.
24	---	Not used	Do not connect anything.
25	---	Not used	Do not connect anything.
26	---	Not used	Do not connect anything.
18	---	Not used	Do not connect anything.

CN1 Control Input Signal Connection Diagram



Note

(1) If the limit input signal inputs (Servo Drive's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Drive will not stop the Servomotor when the signal is input, and the Position Control Unit will also not detect limit inputs as errors. When using a Position Control Unit, always allocate the Servo Drive's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration limit switch) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the Position Control Unit will be unable to detect the input signal.

(3) When selecting a sensor for the origin proximity input signal (origin return deceleration LS), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

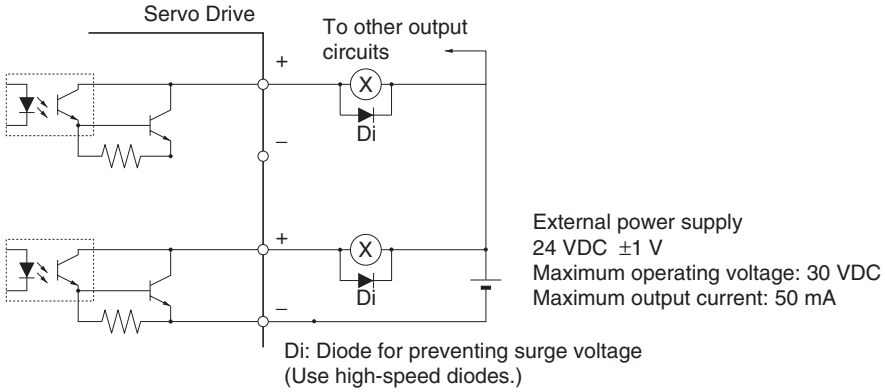
CN1 Control Output Signals

Pin No.	Symbol	Name	Function/Interface
15	/ALM	Alarm Output	The output is OFF when an alarm is generated in the Servo Drive.
16	ALMCOM		
29	OUTM2	General-purpose Output 2 (READY)	This is a general-purpose output. The function for this output is selected by changing the parameter. Refer to Output Signal Assignment Details on the next page.
30	OUTM2COM		
31	OUTM3	General-purpose Output 3 (CLIM)	
32	OUTM3COM		
36	OUTM1	General-purpose Output 1 (BKIR)	
35	OUTM1COM		

■ **Output Signal Assignment Details**

Pn112 (General-purpose Output 1 Function Selection) **Pn113 (General-purpose Output 2 Function Selection)** **Pn114 (General-purpose Output 3 Function Selection)**	**OUTM1 (General-purpose Output 1)** **OUTM2 (General-purpose Output 2)** **OUTM3 (General-purpose Output 3)**	
0	Not assigned	No output. Always OFF.
1	INP1	Positioning Completed 1 output assignment.
2	VCMP	Speed Conformity Signal output assignment.
3	TGON	Servomotor Rotation Speed Detection output assignment.
4	READY	Servo Ready output assignment.
5	CLIM	Current Limit Detection output assignment.
6	VLIM	Speed Limit Detection output assignment.
7	BKIR	Brake Interlock output assignment.
8	WARN	Warning Signal output assignment.
9	INP2	Positioning Completed 2 output assignment.

Control Output Circuits



3-3-3 W-series Servo Drive I/O Signals (R88D-WT□ with JUSP-NS115)

This section explains the I/O signals used between the PCU and a W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module.

Use the *OMNUC W Series User's Manual* together with this manual for information on I/O signals.

Terminal Arrangement of the Control I/O Connector (CN1)

The following diagram shows the terminal arrangement of the W-series Servo Drive's Control I/O Connector (CN1) when MECHATROLINK is being used with the Servo Drive's standard settings.

This diagram shows only the I/O signals used when connecting to the PCU.

For details on the Servo Drive's standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

2	---	---	1	---	---	27	BKIR	Brake interlock output	26	INP1COM	Positioning completed output 1 common
4	---	---	3	---	---	29	READY	Servo ready output	28	BKIRCOM	Brake interlock output common
6	---	---	5	---	---	31	$\overline{\text{ALM}}$	Alarm output	30	READYCOM	Servo ready output common
8	---	---	7	---	---	33	---	---	32	ALMCOM	Alarm output common
10	---	---	9	---	---	35	---	---	34	---	---
12	---	---	11	---	---	37	---	---	36	---	---
14	---	---	13	---	---	39	---	---	38	---	---
16	---	---	15	---	---	41	DEC	Origin return deceleration LS input	40	---	Unused input
18	---	---	17	---	---	43	NOT	Reverse drive prohibit input	42	POT	Forward drive prohibit input
20	---	---	19	---	---	45	EXT2	External latch 2 input	44	EXT1	External latch 1 input
22	BATGND	Backup battery – input	21	BAT	Backup battery + input	47	+24VIN	+24 VDC control power supply input	46	EXT3	External latch 3 input
24	---	---	23	---	---	49	---	---	48	---	---
			25	INP1	Positioning completed output 1				50	---	---

Note (1) Do not connect wiring to unused pins.

(2) Connect the control I/O signal cable's shield wire to the connector shell. The connector on the Servo Drive side is connected to the FG (frame ground).

CN1 Connector (50 Pin)

Name	Model	Manufacturer
Receptacle on Servo Drive Side	10250-52A2JL	Sumitomo 3M
Soldered Plug on Cable Side	10150-3000VE	Sumitomo 3M
Case on Cable Side	10350-52A0-008	Sumitomo 3M

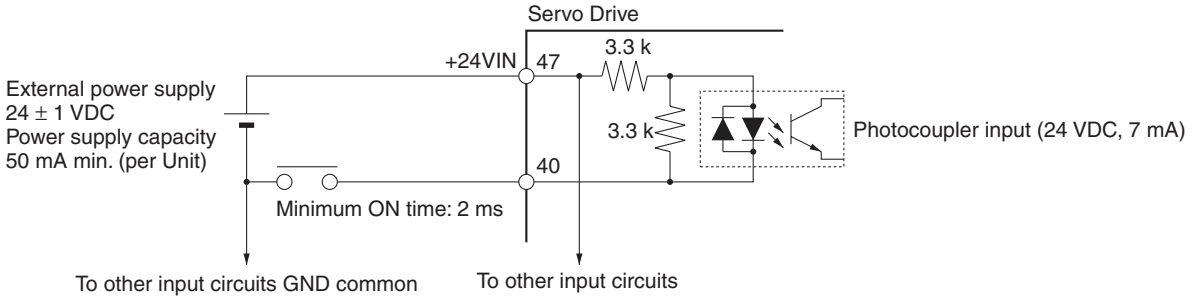
Control I/O Signals

The following tables show the names and functions of the Servo Drive's control I/O signals.

CN1 Control Input Signals

Pin no.	Signal	Name	Function/Interface	Control mode
40	---	Not used.	This control input signal is not used with the standard settings.	---
41	DEC	Origin return deceleration LS	Used as the origin proximity input signal during the origin search operation. With the standard settings, the signal is enabled when ON.	Position
42	POT	Forward drive prohibit input (Positive overtravel)	Used as the forward limit input. With the standard settings, the input is normally closed and operates as follows: OFF: Drive prohibited ON: Drive allowed	All modes
43	NOT	Reverse drive prohibit input (Negative overtravel)	Used as the reverse limit input. With the standard settings, the input is normally closed and operates as follows OFF: Drive prohibited ON: Drive allowed	All modes
44	EXT1	External latch 1 input	Input signal used for external interrupts. Used as an external interrupt input signal during interrupt feeding or an external origin input signal during an origin search. With the standard settings, the signal is enabled when ON.	Position
45	EXT2	External latch 2 input		
46	EXT3	External latch 3 input		
47	+24VIN	+24 VDC control power supply	This is the input terminal for the +24 VDC control input power supply.	All modes

Control Input Circuit



- Signal levels ON: Min. voltage (+24VIN – 11 V)
  OFF: Max. voltage (+24VIN – 1 V)

Note

(1) If the limit input signal inputs (Servo Drive's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Drive will not stop the Servomotor when the signal is input, and the Position Control Unit will also not detect limit inputs as errors. When using a Position Control Unit, always allocate the Servo Drive's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

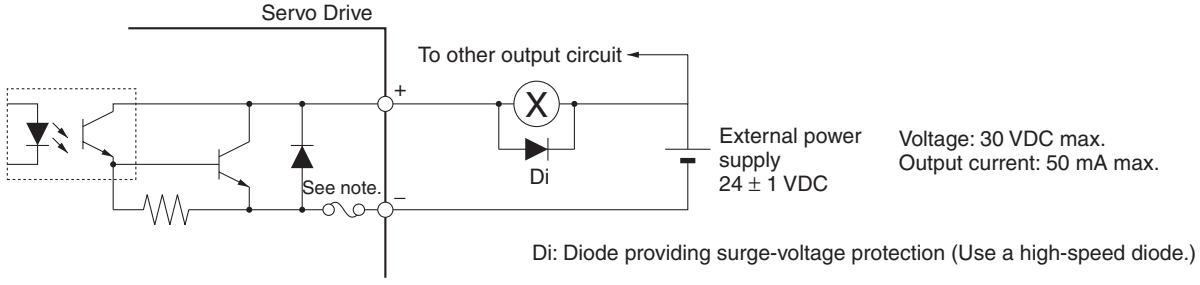
(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration limit switch) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the Position Control Unit will be unable to detect the input signal.

(3) When selecting a sensor for the origin proximity input signal (origin return deceleration LS), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

CN1 Control Output Signals

Pin no.	Signal	Name	Function/Interface	Control mode
25	INP1	Positioning completed output 1	The position deviation is less than positioning completion range 1 (Pn500). (This signal is always OFF in control modes other than position control mode.)	Position
26	INP1COM			
27	BKIR	Brake interlock output	This is the holding brake timing signal that is output according to the settings in parameters Pn506, Pn507, and Pn508.	All modes
28	BKIRCOM			
29	READY	Servo ready output	Turned ON if there are no errors after the control and main circuit power supplies are turned ON.	All modes
30	READYCOM			
31	$\overline{\text{ALM}}$	Alarm output	This output turns OFF when there is a Servo Drive alarm.	All modes
32	ALMCOM			
Shell	FG	Frame ground	Use this terminal to connect the cable's shield and FG wire.	All modes

Control Output Circuit



Note The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current. (Ver. 37 and later Servo Drives are equipped with the auto-resetting circuit breakers.)

3-3-4 W-series Servo Drive I/O Signals (R88D-WN□-ML2 with MECHATROLINK-II Built-in Communications)

This section explains the I/O signals used between the PCU and a W-series Servo Drive equipped with built-in MECHATROLINK-II communications.

Use the *OMNUC W Series User's Manual* (Cat. No. I544) together with this manual for information on I/O signals.

Terminal Arrangement of the Control I/O Connector (CN1)

When using W-series Servo Drives equipped with built-in MECHATROLINK-II communications, the default control I/O signal allocations are the standard Servo Drive settings for using MECHATROLINK.

The following diagram shows the terminal arrangement of the W-series Servo Drive's Control I/O Connector (CN1) when MECHATROLINK is being used with the Servo Drive's default settings.

This diagram shows only the I/O signals used when connecting to the PCU.

For details on the Servo Drive's standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

1	BKIR (SO1+)	Brake interlock output	2	BKIRCOM (SO1−)	Brake interlock output common	14	BAT	Backup battery + input	15	BATGND	Backup battery − input
3	$\overline{\text{ALM}}$	Alarm output	4	ALMCOM	Alarm output common	16	---	---	17	---	---
5	---	---	6	+24VIN	24-VDC control power supply	18	---	---	19	---	---
7	POT	Forward drive prohibited	8	NOT	Reverse drive prohibited	20	---	---	21	---	---
9	DEC	Origin return deceleration limit switch	10	EXT1	External latch 1 input	22	---	---	23	SO2+	Unused output
11	EXT2	External latch 2 input	12	EXT3	External latch 3 input	24	SO2−	Unused output	25	SO3+	Unused output
13	---	Unused input				26	SO3−	Unused output			

Note (1) Do not connect wiring to unused pins.

(2) Connect the control I/O signal cable's shield wire to the connector shell. The connector on the Servo Drive side is connected to the FG (frame ground).

CN1 Connector (26 Pins)

Name	Model	Manufacturer
Receptacle on Servo Drive Side	10226-52A2JL	Sumitomo 3M
Soldered Plug on Cable Side	10126-3000VE	Sumitomo 3M
Case on Cable Side	10326-52A0-008	Sumitomo 3M

Control I/O Signals

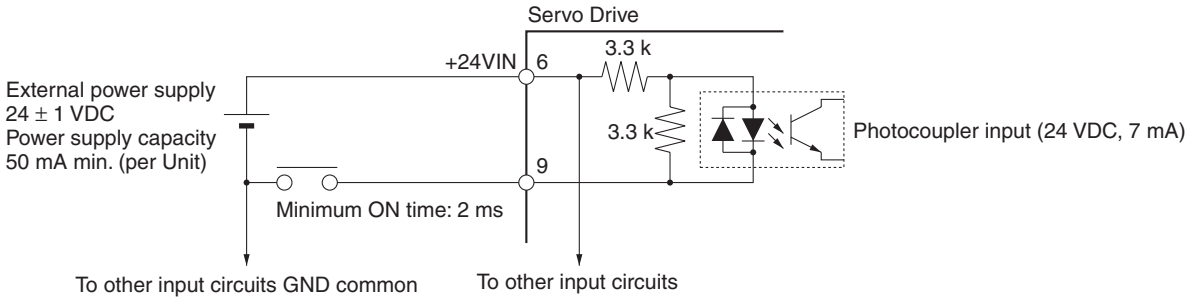
The following tables show the names and functions of the Servo Drive's control I/O signals.

Control Input Signals

Pin No.	Symbol	Name	Function/Interface	Control mode
6	+24VIN	+24 VDC control power supply	This is the input terminal for the +24 VDC control input power supply.	All modes
7	POT	Forward drive prohibited	Used as the forward limit input. With the standard settings, the input is normally closed and operates as follows: OFF: Drive prohibited ON: Drive allowed	All modes
8	NOT	Reverse drive prohibited	Used as the reverse limit input. With the standard settings, the input is normally closed and operates as follows OFF: Drive prohibited ON: Drive allowed	All modes
9	DEC	Origin return deceleration limit switch	Used as the origin proximity input signal during the origin search operation. With the standard settings, the signal is enabled when ON.	Position

Pin No.	Symbol	Name	Function/Interface	Control mode
10	EXT1	External latch 1 input	Input signal used for external interrupts.	Position
11	EXT2	External latch 2 input	Used as an external interrupt input signal during interrupt feeding or an external origin input signal during an origin search.	
12	EXT3	External latch 3 input	With the standard settings, the signal is enabled when ON.	
13	---	Not used.	This control input signal is not used with the standard settings.	---

Control Input Circuit



• Signal levels ON: Min. voltage (+24VIN – 11 V)
OFF: Max. voltage (+24VIN – 1 V)

Note

(1) If the limit input signal inputs (Servo Drive's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Drive will not stop the Servomotor when the signal is input, and the Position Control Unit will also not detect limit inputs as errors. When using a Position Control Unit, always allocate the Servo Drive's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration limit switch) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the Position Control Unit will be unable to detect the input signal.

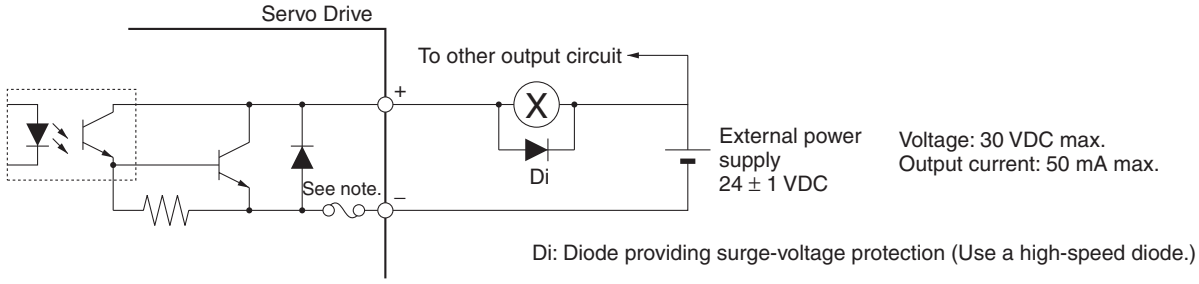
(3) When selecting a sensor for the origin proximity input signal (origin return deceleration LS), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

Control Output Signals

Pin No.	Symbol	Name	Function/Interface	Control mode
1	BKIR (SO1+)	Brake interlock output	This is the holding brake timing signal that is output according to the settings in parameters Pn506, Pn507, and Pn508.	All modes
2	BKIRCOM (SO1–)			
3	$\overline{\text{ALM}}$	Alarm output	This output turns OFF when there is a Servo Drive alarm.	All modes
4	ALMCOM			

Pin No.	Symbol	Name	Function/Interface	Control mode
23	SO2+	General-purpose output	These control input signals are not used with the standard settings.	All modes
24	SO2−			
25	SO3+			
26	SO3−			
Shell	FG	Frame ground	Use this terminal to connect the cable's shield and FG wire.	All modes

Control Output Circuit



Note The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current.

3-3-5 SMARTSTEP Junior Servo Drive I/O Signals (R7D-ZN□-ML2 with Built-in MECHATROLINK-II Communications)

This section describes the standard I/O signals used with a Position Control Unit when using a SMARTSTEP Junior Servo Drive with Built-in MECHATROLINK-II Communications.

Refer also to the *SMARTSTEP Junior Servo Drive with MECHATROLINK-II Communications User's Manual* (Cat. No. I554).

Terminal Arrangement of Control I/O Connector (CN1)

The default control I/O signal allocations for a SMARTSTEP Junior Servo Drive with MECHATROLINK-II Communications are set to the standard Servo Drive settings for using MECHATROLINK. The default pin arrangement of the control I/O connector (CN1) on the Servo Drive are shown below.

Only the I/O signals that are connected to the Position Control Unit are shown. Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK* for the standard Servo Drive settings for using MECHATROLINK.

			1	EXT1	External latch signal 1 input				8	---	---
2	DEC	Origin proximity input				9	---	---			
4	POT	Forward drive inhibit input	3	NOT	Reverse drive inhibit input	11	---	---	10	---	---
6	STOP	Emergency stop input	5	+24VIN	+24 VDC control power supply input	13	BKIR	Brake interlock output	12	$\overline{\text{ALM}}$	Alarm output
			7	0GND	Output ground common				14	---	---

Note (1) Do not connect unused pins.

(2) Connect the shield in the control I/O signal cable to the connector hood. At the Servo Drive connector, connect it to the FG (Frame ground).

CN1 Connector (14 Pins)

Name	Model	Manufacturer
Receptacle on Servo Drive Side	10226-52A2JL	Sumitomo 3M
Soldered Plug on Cable Side	10126-3000VE	Sumitomo 3M
Case on Cable Side	10326-52A0-008	Sumitomo 3M

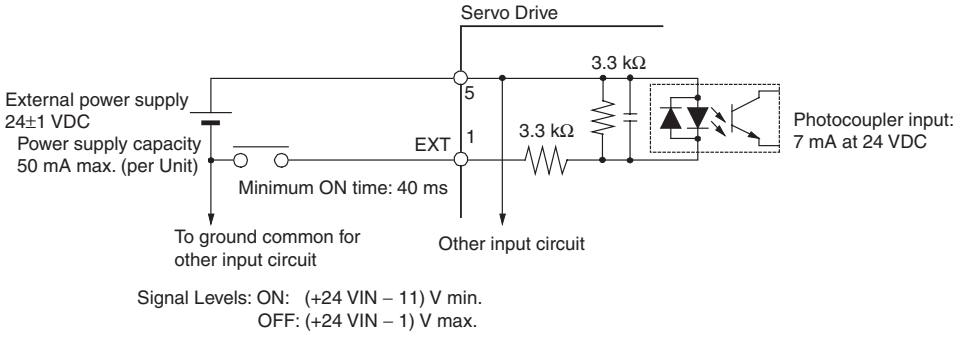
Control I/O Signals

The names and functions of Servo Drive control I/O signals are given in the following table.

CN1 Control Input Signals

Pin No.	Signal	Name	Function/interface	Control mode
1	EXT1	External latch signal 1 input	An external interrupt input signal. Use as an external interrupt signal for interrupt feeding or as external origin input signal for origin searches. The signal is valid when ON.	Position
2	DEC	Origin proximity input	The origin proximity input signal for origin searches. The signal is valid when ON.	All modes
3	NOT	Reverse drive inhibit input	The limit input in the reverse direction. This input operates as follows (i.e., like a NC contact): OFF: Drive prohibited, ON: Drive enabled	All modes
4	POT	Forward drive inhibit input	The limit input in the forward direction. This input operates as follows (i.e., like a NC contact): OFF: Drive prohibited, ON: Drive enabled	All modes
5	+24VIN	+24-V power supply input for control DC	The +24 VDC input terminal for the control input power supply.	All modes
6	STOP	Emergency stop input	An external input signal used to stop power supply to the motor. This input is used when an error occurs to unlock the Servo from a host controller. This input operates as follows (i.e., like a NC contact): OFF: Power to motor stopped (Servo cannot be locked). ON: Power can be supplied to motor (Servo can be locked).	All modes

Control Input Circuits



Signal Levels: ON: (+24 VIN – 11) V min.
OFF: (+24 VIN – 1) V max.

Note

(1) If the limit input signal inputs (Servo Drive's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Drive will not stop the Servomotor when the signal is input, and the Position Control Unit will also not detect limit inputs as errors. When using a Position Control Unit, always allocate the Servo Drive's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration limit switch) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the Position Control Unit will be unable to detect the input signal.

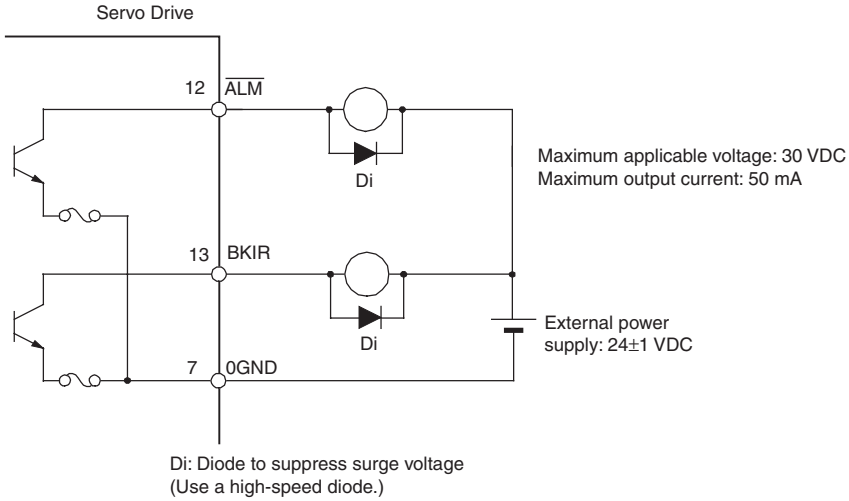
(3) When selecting a sensor for the origin proximity input signal (origin return deceleration LS), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

(4) The SMARTSTEP Junior Servo Drive's emergency stop input stops the Servomotor using software processing. If required for system safety, add a safety circuit in an external circuit.

CN1 Control Output Signals

Pin No.	Signal	Name	Function/interface	Control mode
7	0GND	Output ground common	The ground common for control output signals.	All modes
12	$\overline{\text{ALM}}$	Alarm output	Turns OFF when an alarm occurs in the Servo Drive.	All modes
13	BKIR	Brake interlock output	Output as a timing signal for a holding brake when the Servo is locked or unlocked.	All modes
Shell	FG	Frame ground	The connection point for the cable shield and FG line.	All modes

Control Input Circuits



Note The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current.

3-4 Wiring

This section provides examples of the connections between the PCU and Servo Drive as well as the Servo Drive's control I/O connections.

3-4-1 MECHATROLINK-II Communications Wiring

Use the special MECHATROLINK-II Connection Cable to connect the PCU and Servo Drive (MECHATROLINK-II Application Module).

Connection Cable

Use the following cables (made by Yaskawa Electric) to connect MECHATROLINK-II devices.

Name	Model number	Cable length	Manufacturer
MECHATROLINK-II Connection Cable (USB connectors and ferrite cores on both ends)	JEPMC-W6003-A5	0.5 m	Yaskawa Electric Corporation
	JEPMC-W6003-01	1.0 m	
	JEPMC-W6003-03	3.0 m	
	JEPMC-W6003-05	5.0 m	
	JEPMC-W6003-10	10 m	
	JEPMC-W6003-20	20 m	
	JEPMC-W6003-30	30 m	

Terminators

Make sure to connect the following Terminator at the end of the MECHATROLINK-II communications line.

Name	Model number	Manufacturer
MECHATROLINK-II Terminator	JEPMC-W6022	Yaskawa Electric Corporation

Repeaters

The wiring distance for the MECHATROLINK-II can be extended to a maximum of 100 m by using Repeaters.

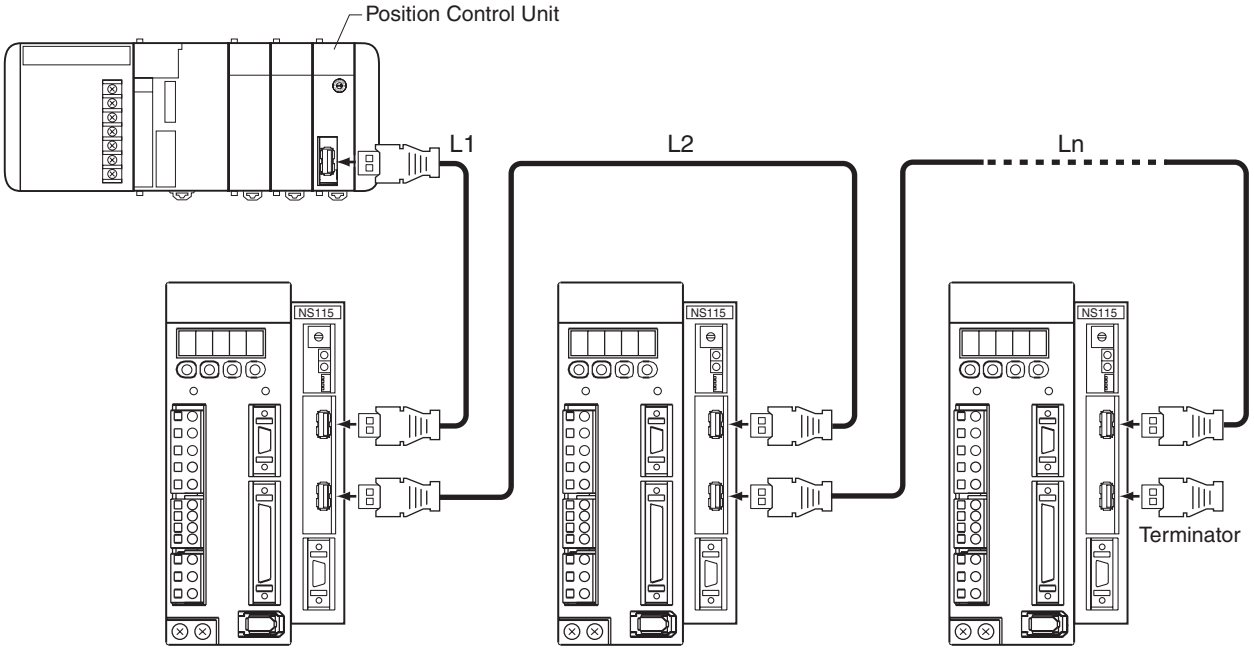
Name	Model number	Manufacturer
MECHATROLINK-II Repeater	JEPMC-REP2000	Yaskawa Electric Corporation

Note MECHATROLINK-II Connection Cables and Terminators can be ordered from OMRON with the following model numbers.

Name	Yaskawa Electric Co. model number	OMRON model number
MECHATROLINK-II Connection Cable (USB connectors and ferrite cores on both ends)	JEPMC-W6003-A5	FNY-W6003-A5
	JEPMC-W6003-01	FNY-W6003-01
	JEPMC-W6003-03	FNY-W6003-03
	JEPMC-W6003-05	FNY-W6003-05
	JEPMC-W6003-10	FNY-W6003-10
	JEPMC-W6003-20	FNY-W6003-20
	JEPMC-W6003-30	FNY-W6003-30
MECHATROLINK-II Terminator	JEPMC-W6022	FNY-W6022
MECHATROLINK-II Repeater	JEPMC-REP2000	FNY-REP2000

MECHATROLINK-II Communications Connections

The following example shows a PCU connected with several Servo Drives with the MECHATROLINK-II Connection Cables.



Note When not using Repeaters, the maximum total length of the Connection Cable (L1 + L2 + ... + Ln) is 50 m when using fewer than 16 axes or 30 m when using 16 axes.

MECHATROLINK-II Connection Cable Length

The maximum total length of the Connection Cables depends on the number of MECHATROLINK devices (Servo Drives) being connected, as shown in the following table.

Repeaters	Number of MECHATROLINK devices		Minimum cable length between devices	Maximum total cable length
Without Repeaters	15 or fewer		0.5 m min.	50 m max.
	16		0.5 m min.	30 m max.
With Repeaters	Between PCU and Repeater	14 or fewer	0.5 m min.	50 m max.
		15	0.5 m min.	30 m max.
	Between Repeater and Terminator	15 or fewer	0.5 m min.	50 m max.
		16	0.5 m min.	30 m max.

Note The number of devices in the table for when Repeaters are used does not include the Repeaters. For example, if using one MECHATROLINK device between the PCU and the Repeater and 15 MECHATROLINK devices between the Repeater and the Terminator, there will be 16 MECHATROLINK devices and the maximum total cable length is 100 m.

Note Always turn OFF the power supply to the PCU and Servo Drives before connecting or disconnecting MECHATROLINK-II Connection Cables or the Terminator.

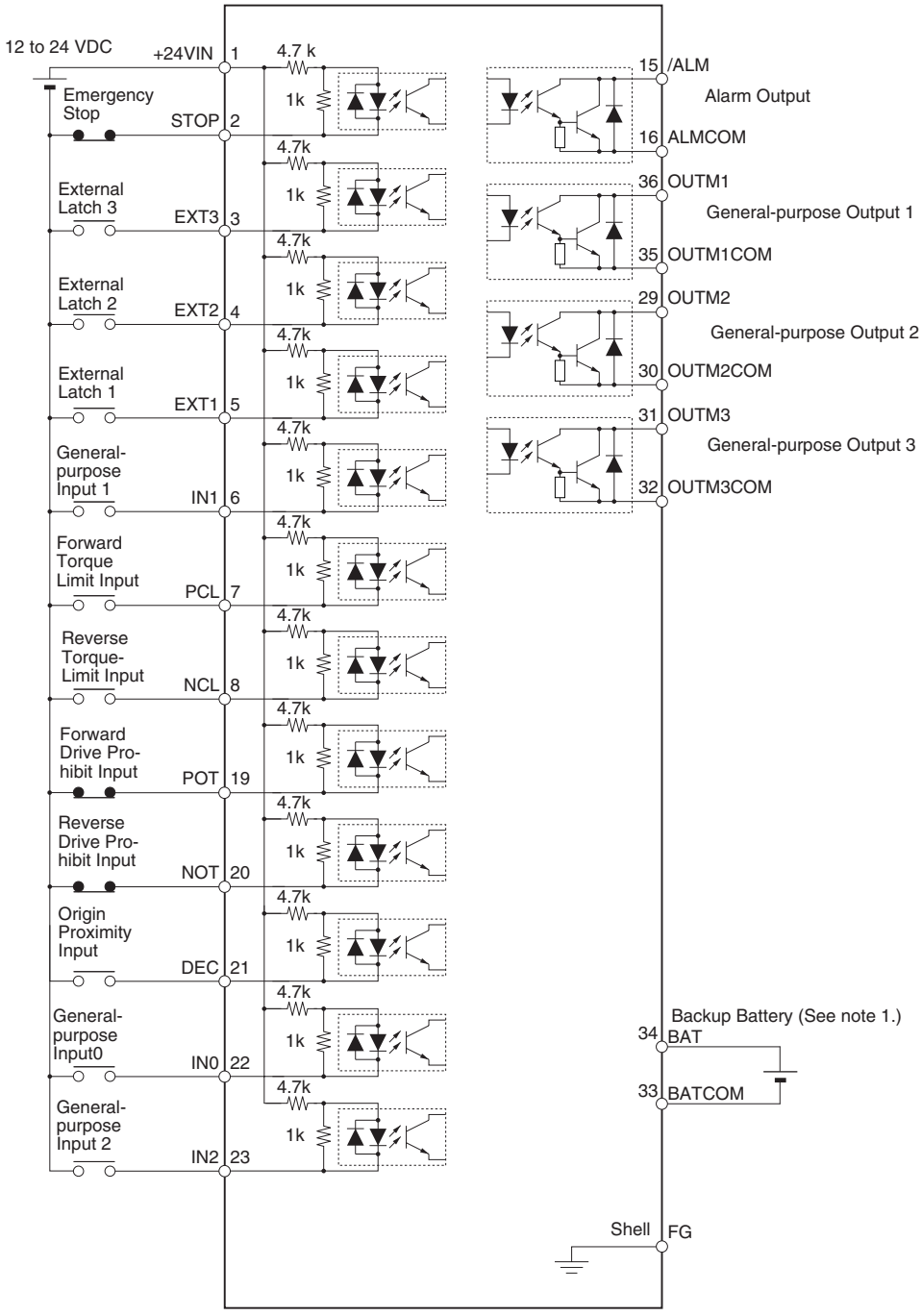
3-4-2 Wiring the Servo Drive I/O Signals

The following example shows a Servo Drive's control I/O signal connections when a Position Control Unit is connected to a G-series Servo Drive, a W-series Servo Drive, or a SMARTSTEP Junior Servo Drive.

For details on connecting the Servo Drive to the power supply or Servomotor, refer to the Servo Drive operation manual.

Control I/O Connector (CN1) Connection Example

R88D-GN□-ML2 (Equipped with Built-in MECHATROLINK-II Communications)

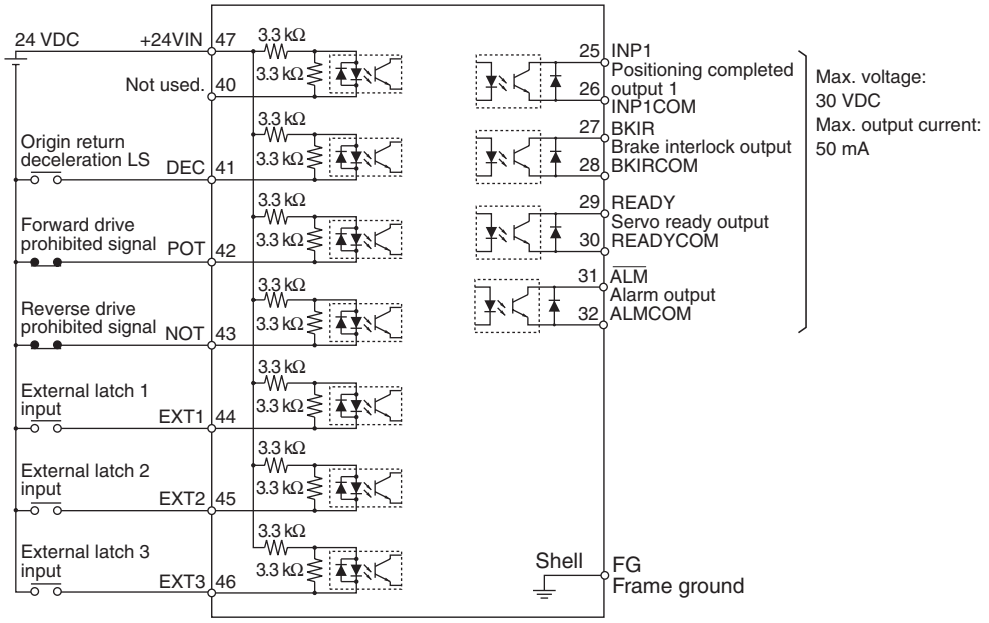


Note (1) If a backup battery is connected, a cable with a battery is not required.

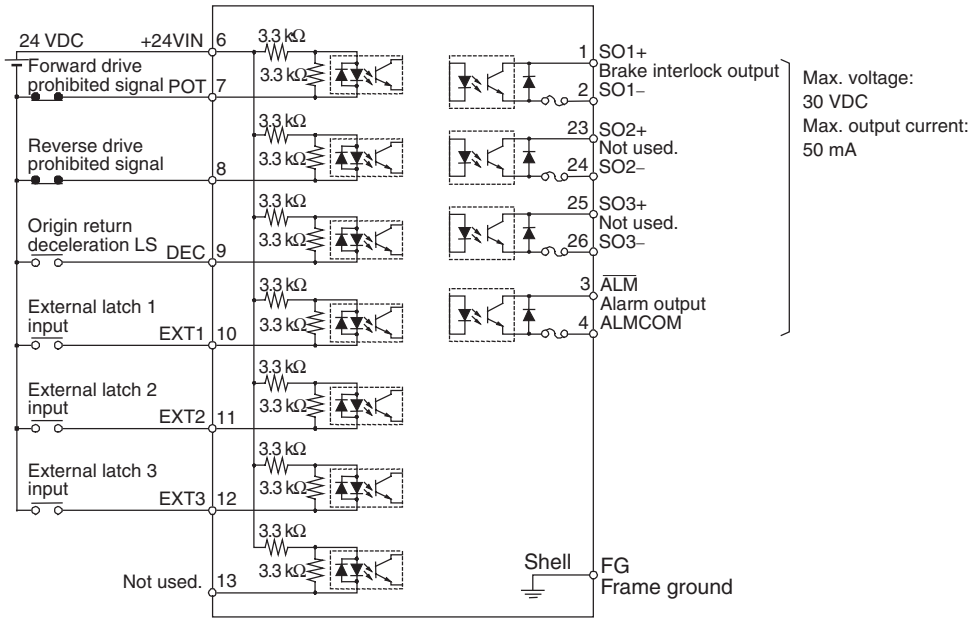
(2) Inputs for pins 19 and 20 are determined by parameter settings. The diagram shows the default configuration.

R88D-WT□ with JUSP-NS115

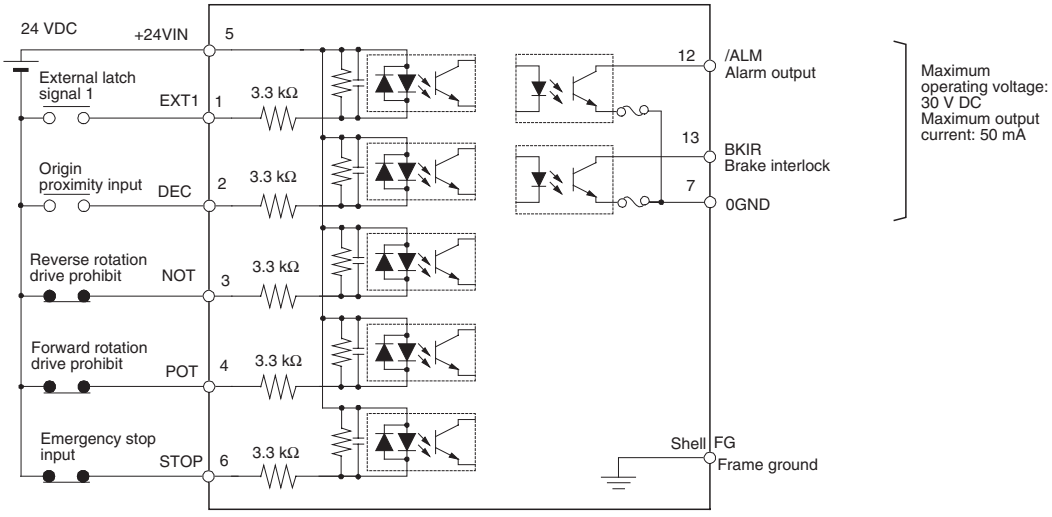
The following example shows the connections when the standard I/O signal settings are being used.



R88D-WN□-ML2 (Equipped with Built-in MECHATROLINK-II Communications)



R7D-ZN□-ML2 (Equipped with Built-in MECHATROLINK-II Communications)



Note When a Servo Drive is controlled through MECHATROLINK-II communications, software processes are used to stop the Servomotor when the corresponding PCU control signal is received, the Servo Drive's drive prohibited input signal is received, or an error occurs. Use an external fail-safe circuit (outside of the Servo Drive), such as a circuit that disconnects the Servo Drive's main power supply, to stop the system in an emergency.

Components Provided to Wire Control I/O Signals

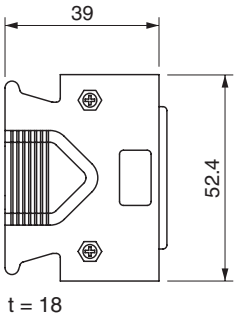
The following components are provided to wire the Control I/O Connector (CN1) on a G-series, W-series, or SMARTSTEP Junior Servo Drive.

Control I/O Connector (R88A-CNU01C)

This connector connects to the Control I/O Connector (CN1) on a G-series Servo Drive (R88D- GN□-ML2).

Use this connector when making your own control cable.

Dimensions



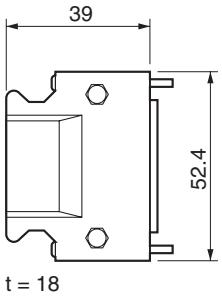
Connector Plug model
10136-3000PE (Sumitomo 3M)
Connector Case model
10336-52A0-008 (Sumitomo 3M)

Control I/O Connector (R88A-CNU11C)

This connector connects to the W-series Servo Drive's Control I/O Connector (CN1).

Use this connector when making your own control cable.

Dimensions



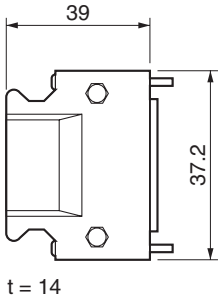
Connector Plug model
10150-3000VE (Sumitomo 3M)
Connector Case model
10350-52A0-008 (Sumitomo 3M)

Control I/O Connector (R88A-CNW01C)

This connector connects to the R88D-WN□-ML2 W-series Servo Drive's Control I/O Connector (CN1).

Use this connector when making your own control cable.

Dimensions

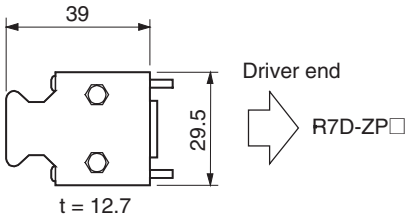


Connector plug: 10126-3000VE (Sumitomo 3M)
Connector case: 10326-52A0-008 (Sumitomo 3M)

Control I/O Connector (R7A-CNA01R)

This connector connects to the R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive's Control I/O Connector (CN1).

Use this connector when making your own control cable.



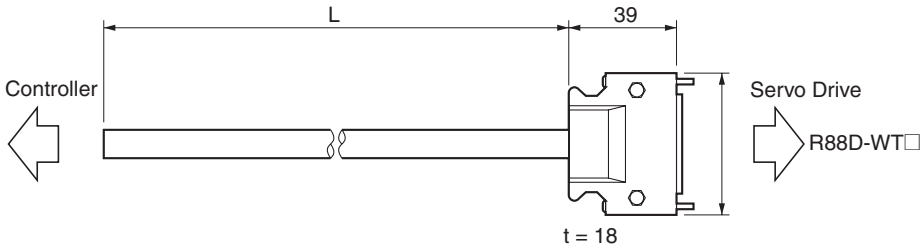
General-purpose Control Cable (R88A-CPW□S)

This cable has a connector already attached, which connects to the R88D-WT□ W-series Servo Drive's Control I/O Connector (CN1). There is no connector attached to the other end of the cable. Attach an appropriate connector to connect the desired I/O device in order to use the cable.

Standard Cables

Model	Length (L)	Sheath diameter	Approx. weight
R88A-CPW001S	1 m	12.8-mm dia.	0.3 kg
R88A-CPW002S	2 m		0.6 kg

Connection Configuration and Dimensions



Wiring

No.	Wire/Marking colors	Signal
1	Yellow/Black (– – –)	---
2	Pink/Black (– – – –)	---
3	Yellow/Red (– – – – –)	---
4	Pink/Red (– – – –)	---
5	Orange/Red (–)	---
6	Orange/Black (–)	---
7	Gray/Red (–)	---
8	Gray/Black (–)	---
9	White/Red (–)	---
10	White/Black (–)	---
11	Yellow/Red (–)	---
12	Yellow/Black (–)	---
13	Yellow/Black (– – – – –)	---
14	Pink/Black (–)	---
15	Pink/Red (–)	---
16	Orange/Red (– – – – –)	---
17	Orange/Black (– – – – –)	---
18	Pink/Red (– – – – –)	---
19	Gray/Red (– –)	---
20	Gray/Black (– –)	---
21	Gray/Red (– – – – –)	---
22	Gray/Black (– – – – –)	---
23	White/Red (– – – – –)	---
24	White/Black (– – – – –)	---
25	Orange/Red (– –)	INP1
26	Orange/Black (– –)	INP1COM

No.	Wire/Marking colors	Signal
27	White/Red (– –)	BKIR
28	White/Black (– –)	BKIRCOM
29	Yellow/Red (– –)	READY
30	Yellow/Black (– –)	READYCOM
31	Pink/Red (– –)	---
32	Pink/Black (– –)	---
33	Orange/Red (– – –)	---
34	Orange/Black (– – –)	---
35	Gray/Black (– – –)	---
36	Gray/Red (– – –)	---
37	White/Red (– – –)	---
38	White/Black (– – –)	---
39	Yellow/Red (– – –)	---
40	Pink/Red (– – –)	(Not used.)
41	Pink/Black (– – –)	DEC
42	Orange/Red (– – – –)	POT
43	Orange/Black (– – – –)	NOT
44	Gray/Black (– – – –)	EXT1
45	White/Red (– – – –)	EXT2
46	White/Black (– – – –)	EXT3
47	Gray/Red (– – – –)	+24VIN
48	Yellow/Red (– – – –)	---
49	Yellow/Black (– – – –)	---
50	Pink/Black (– – – – –)	---
Shell	---	FG

Connector Plug model: 10150-3000VE (Sumitomo 3M)
Connector Case model: 10350-52A0-008 (Sumitomo 3M)
Cable: 24 AWG, 25 wire, UL20276

Note

(1) Wires with the same wire color and number of marks make up a twisted pair.
For example, the Orange/Red (–) and Orange/Black (–) wires make up a twisted pair.

(2) The I/O signals listed in the table above are applicable only when connecting to the PCU. Do not wire any unused signals.

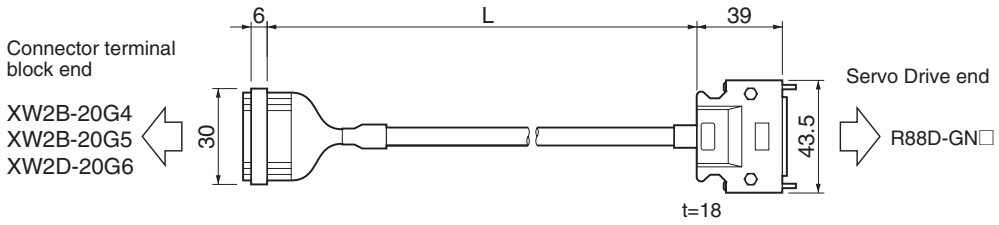
Connector Terminal Block Cables (XW2Z-□J-B33)

This is the Connector Terminal Block Cable for G-series Servo Drives (R88D-WN□-ML2 with built-in MECHATROLINK-II communications).

Standard Cables

Model	Length (L)	Outer diameter of cable	Approx. weight
XW2Z-100J-B33	1 m	8.0 dia.	0.1 kg
XW2Z-200J-B33	2 m		0.2 kg

Connection Configuration and Dimensions



Wiring

Terminal block		Connector	Servo Drive		
Signal	No.	No.	No.	Wire/mark color	Signal
+24VIN	1	1	1	Blue/Red (1)	+24VIN
0V	2	2		Blue/Black (1)	
+24VIN	3	3		Pink/Red (1)	
0V	4	4		Pink/Black (1)	
+24VIN	5	5		Green/Red (1)	
0V	6	6		Green/Black (1)	
STOP	7	7	2	Orange/Red (1)	STOP
DEC	8	8	21	Orange/Black (1)	DEC
POT	9	9	19	Gray/Red (1)	POT
NOT	10	10	20	Gray/Black (1)	NOT
EXT1	11	11	5	Blue/Red (2)	EXT1
EXT2	12	12	4	Blue/Black (2)	EXT2
EXT3	13	13	3	Pink/Red (2)	EXT3
BATCOM	14	14	33	Green/Red (2)	BATCOM
BAT	15	15	34	Green/Black (2)	BAT
OUTM1COM	16	16	35	Orange/Red (2)	OUTM1COM
OUTM1	17	17	36	Orange/Black (2)	OUTM1
ALMCOM	18	18	16	Gray/Red (2)	ALMCOM
/ALM	19	19	15	Gray/Black (2)	/ALM
FG	20	20	Shell	Not specified.	FG

- Wires with the same wire color and the same number of marks form a twisted pair.

  A pink/red (1) wire and pink/black (1) wire form a twisted pair.

  Servo Drive Connector
  Connector plug: 10136-3000PE (Sumitomo 3M)
  Connector case: 10336-52A0-008 (Sumitomo 3M)

  Terminal Block Connector
  Connector socket: XG4M-2030 (OMRON)
  Strain relief: XG4T-2004 (OMRON)

  Cable
  AWG28×10P UL2464

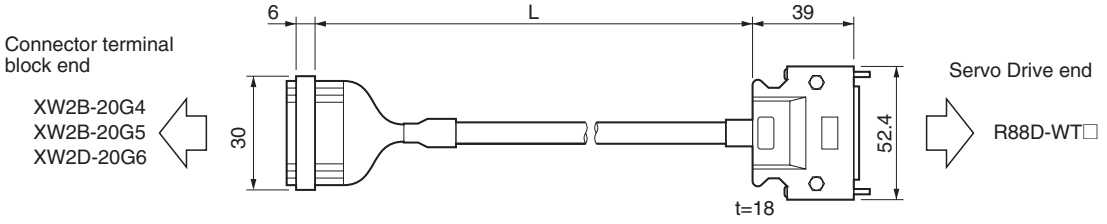
Connector Terminal Block Cables (XW2Z-□J-B15)

This cable connects to the R88D-WT□ W-series Servo Drive's connector terminal block.

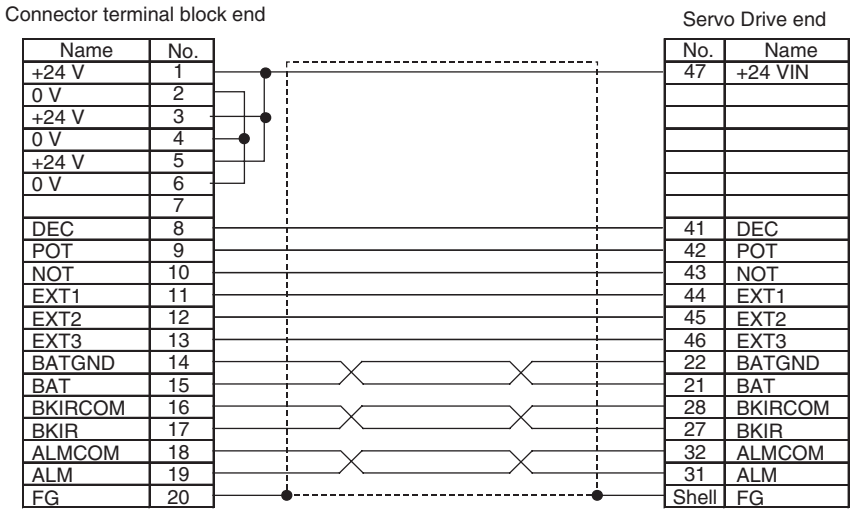
Standard Cables

Model	Length (L)	Approx. weight
XW2Z-100J-B15	1 m	0.1 kg
XW2Z-200J-B15	2 m	0.2 kg

Connection Configuration and Dimensions



Wiring



Connector on Servo Drive End
Connector Plug: 10150-300VE (Sumitomo 3M)
Connector Case: 10350-52A0-008 (Sumitomo 3M)

Connector on Connector Terminal Block End
Connector Socket: XG4M-2030 (OMRON)
Strain Relief: XG4T-2004 (OMRON)

Cable: AWG28 × 3P + AWG28 × 7C UL2464

Note Signal names for the connector on the Servo Drive end are for standard I/O allocations.

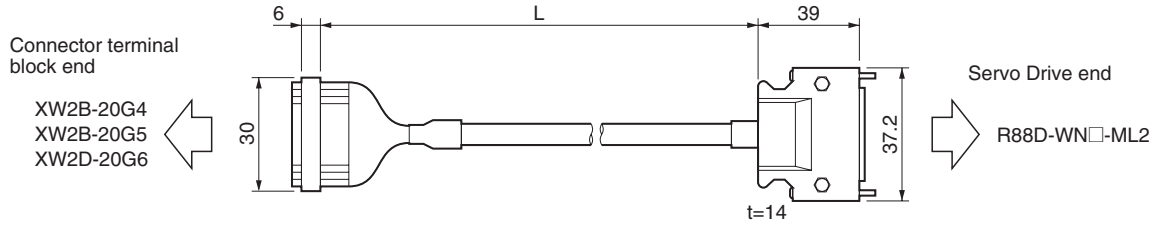
Connector Terminal Block Cables (XW2Z-□J-B16)

This is the Connector Terminal Block Cable for W-series Servo Drives (R88D-WN□-ML2 with built-in MECHATROLINK-II communications).

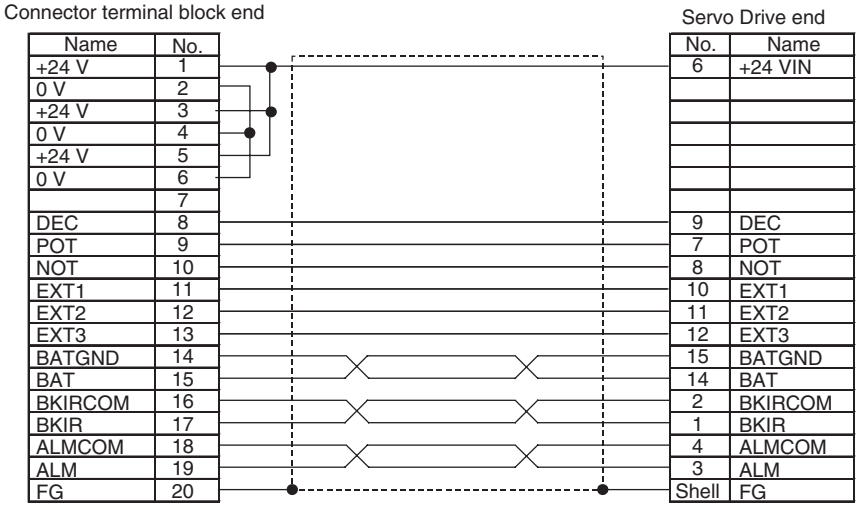
Standard Cables

Model	Length (L)	Approx. weight
XW2Z-100J-B16	1 m	0.1 kg
XW2Z-200J-B16	2 m	0.2 kg

Connection Configuration and Dimensions



Wiring



Connector on Servo Drive End
Connector Plug: 10126-300VE (Sumitomo 3M)
Connector Case: 10326-52A0-008 (Sumitomo 3M)

Connector on Connector Terminal Block End
Connector Socket: XG4M-2030 (OMRON)
Strain Relief: XG4T-2004 (OMRON)

Cable: AWG28 × 3P + AWG28 × 7C UL2464

Note Signal names for the connector on the Servo Drive end are for standard I/O allocations.

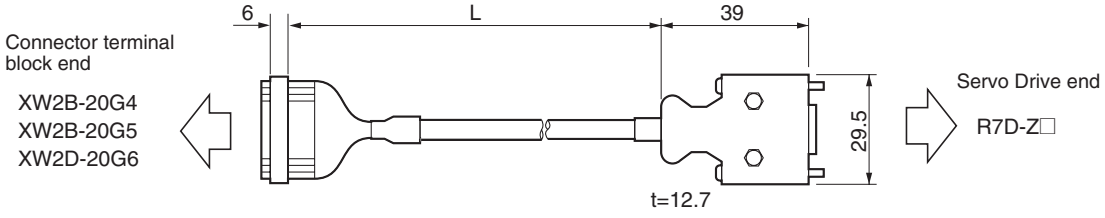
Connector Terminal Block Cable (XW2Z-□J-B19)

This is the Connector Terminal Block Cable for the SMARTSTEP Junior Servo Drive Control I/O Connector (CN1).

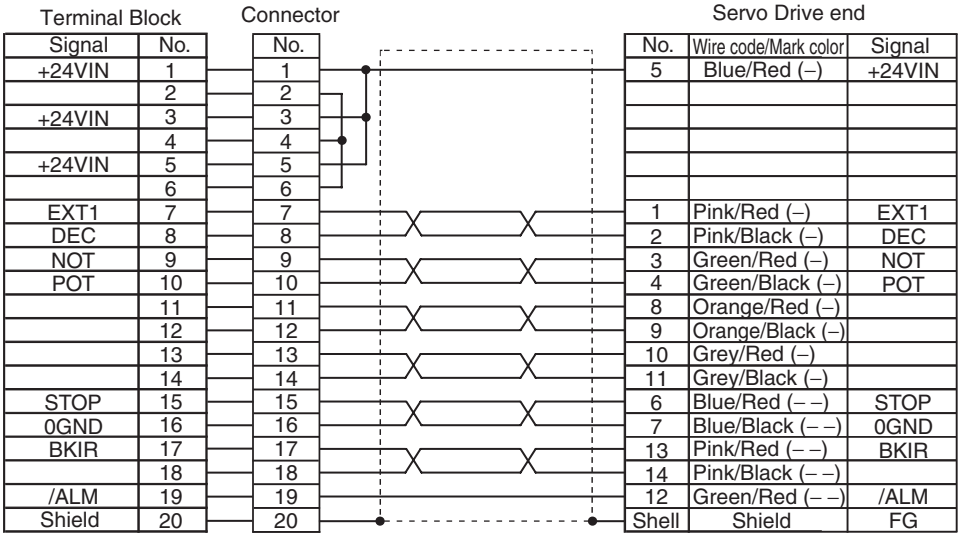
Standard Cables

Model	Length (L)	Outer diameter of cable	Approx. weight
XW2Z-100J-B19	1 m	8 dia.	0.1 kg
XW2Z-200J-B19	2 m		0.2 kg

Connection Configuration and Dimensions



Wiring



Terminal Block Signal	Terminal Block No.	Connector No.	Servo Drive end No.	Servo Drive end Wire code/Mark color	Servo Drive end Signal
+24VIN	1	1	5	Blue/Red (–)	+24VIN
	2	2			
+24VIN	3	3			
	4	4			
+24VIN	5	5			
	6	6			
EXT1	7	7	1	Pink/Red (–)	EXT1
DEC	8	8	2	Pink/Black (–)	DEC
NOT	9	9	3	Green/Red (–)	NOT
POT	10	10	4	Green/Black (–)	POT
	11	11	8	Orange/Red (–)	
	12	12	9	Orange/Black (–)	
	13	13	10	Grey/Red (–)	
	14	14	11	Grey/Black (–)	
STOP	15	15	6	Blue/Red (– –)	STOP
0GND	16	16	7	Blue/Black (– –)	0GND
BKIR	17	17	13	Pink/Red (– –)	BKIR
	18	18	14	Pink/Black (– –)	
/ALM	19	19	12	Green/Red (– –)	/ALM
Shield	20	20	Shell	Shield	FG

Connector at Connector Terminal Block
Connector Socket: XG4M-2030
Strain Relief: XG4T-5004

Cable: AWG28-10P UL20276

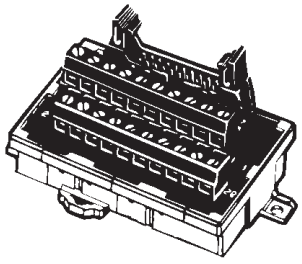
Connector at Servo Drive
Connector Plug: 10114-3000PE (Sumitomo 3M)
Connector Case: 10314-52A0-008 (Sumitomo 3M)

Connector-Terminal Conversion Units

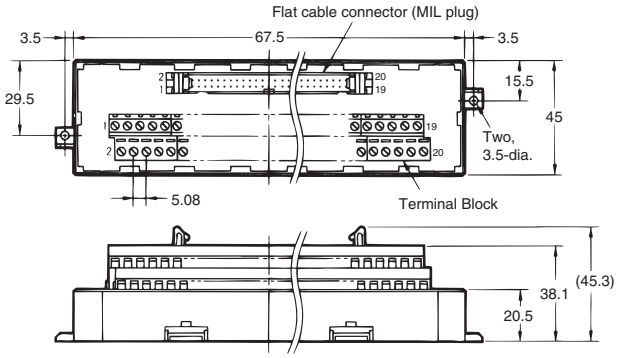
The Connector-Terminal Block Conversion Unit can be used along with a Connector Terminal Block Cable (XW2Z-□J-B15/B16/B19/B33) to convert the control I/O connector (CN1) of a G-series Servo Drive, W-series Servo Drive, or SMARTSTEP Junior Servo Drive to a terminal block.

XW2B-20G4

The XW2B-20G4 is an M3 Screw Terminal Block.



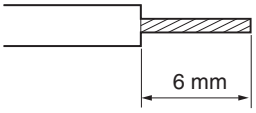
Dimensions



Note (1) Use 0.30 to 1.25 mm^2 wire (AWG22 to AWG16).

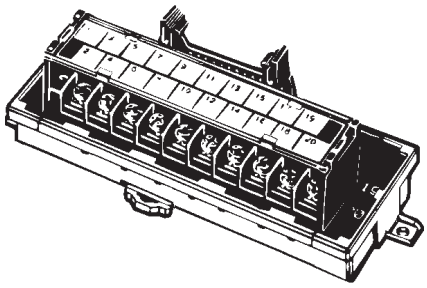
(2) The wire inlet is 1.8 mm (height) × 2.5 mm (width).

(3) Strip the insulation from the end of the wire for 6 mm as shown below.

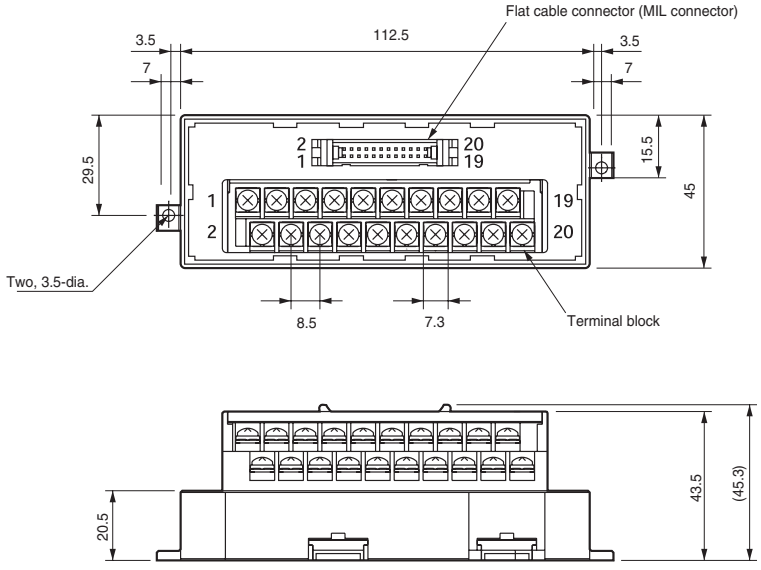


XW2B-20G5

The XW2B-20G5 is an M3.5 Screw Terminal Block.



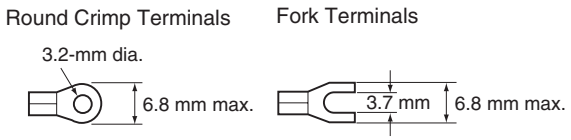
Dimensions



- Terminal block pitch: 8.5 mm

Note (1) When using crimp terminals, use crimp terminals with the following dimensions.

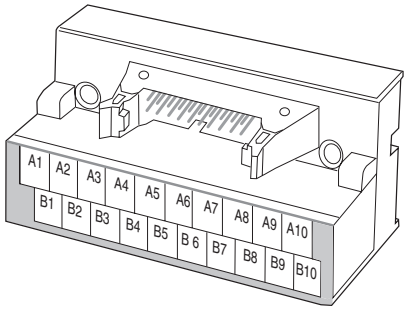
(2) When connecting wires and crimp terminals to a terminal block, tighten them with a tightening torque of 0.59 N·m.



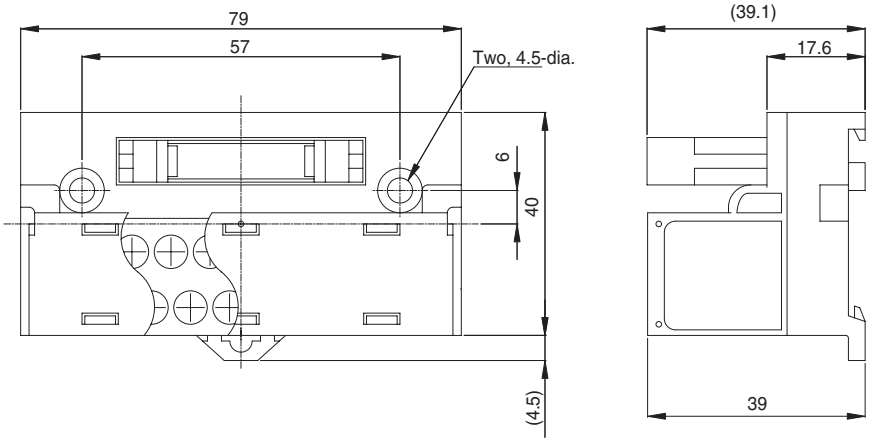
Applicable Crimp Terminals		Applicable Wires
Round Crimp Terminals	1.25-3	AWG22-16 (0.3 to 1.25 mm^2)
	2-3.5	AWG16-14 (1.25 to 2.0 mm^2)
Fork Terminals	1.25Y-3	AWG22-16 (0.3 to 1.25 mm^2)
	2-3.5	AWG16-14 (1.25 to 2.0 mm^2)

XW2D-20G6

The XW2D-20G6 is an M3 Screw Terminal Block.

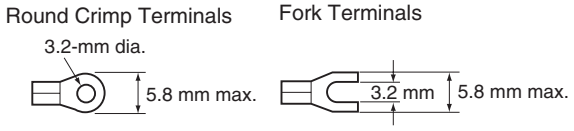


Dimensions



Note (1) When using crimp terminals, use crimp terminals with the following dimensions.

(2) When connecting wires and crimp terminals to a terminal block, tighten them with a tightening torque of 0.7 N·m.

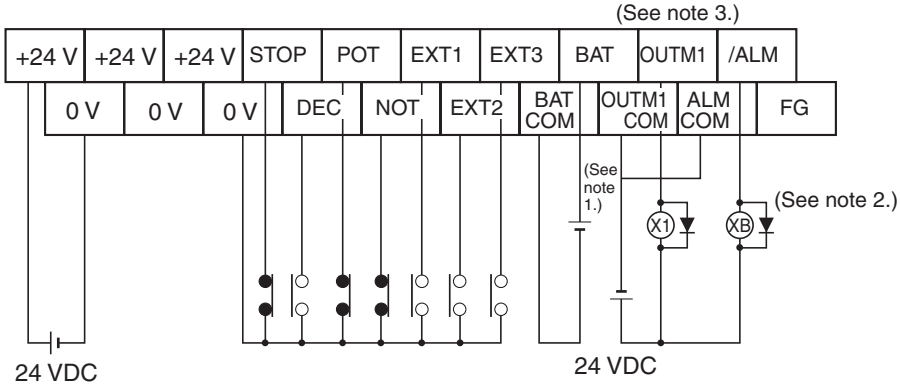


Applicable Crimp Terminals		Applicable Wires
Round Crimp Terminals	1.25-3	AWG22-16 (0.3 to 1.25 mm^2)
Fork Terminals	1.25Y-3	AWG22-16 (0.3 to 1.25 mm^2)

The following diagrams show typical connections between a host device and Servo Drives using a MECHATROLINK-II communications cable.

■ **G-series Servo Drives**

Terminal Block Wiring Example (Same for XW2B-20G4, XW2B-20G5, and XW2D-20G6)



Note

(1) Absolute encoder backup battery 3.6 to 4.5 V

(2) The XB contacts are used to turn ON/OFF the electromagnetic brake.

(3) Assign BKIR (brake interlock) to CN1-36 pin to use.

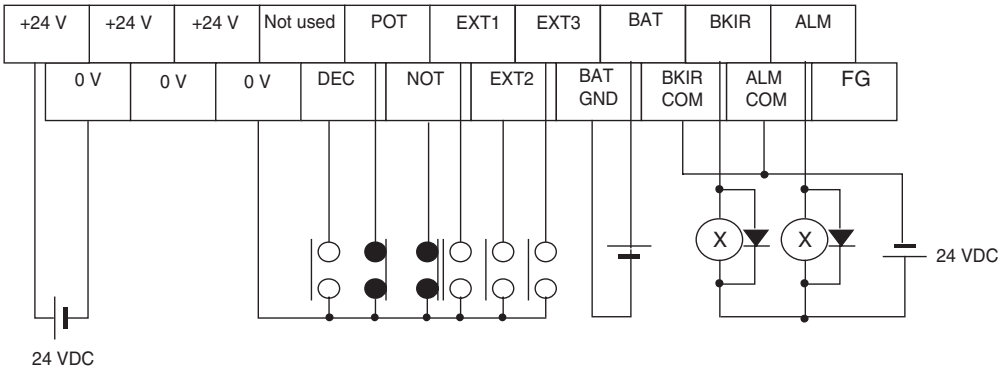
(4) The absolute encoder backup battery is not required when using a Servomotor with an incremental encoder.

(5) Connect the absolute encoder backup battery to only one of either the connector terminal block or absolute encoder backup battery cable.

(6) Use cable clips with double-sided adhesive tape to secure the absolute encoder backup battery in place.

■ **W-series Servo Drives**

Terminal Block Wiring Example (Same for All Models; with Standard Settings for I/O Allocations)

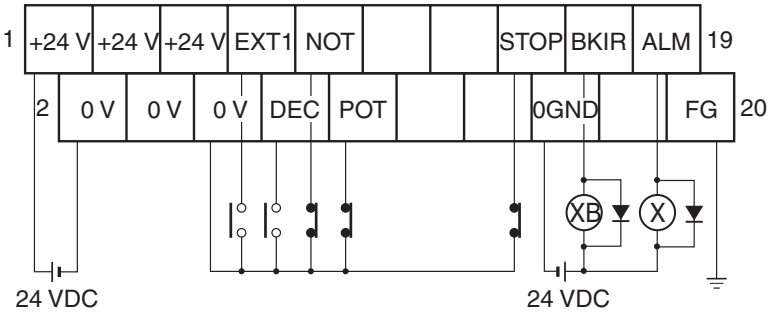


Note

(1) Absolute Encoder Backup Battery: 2.8 to 4.5 V
When using a motor with an absolute encoder, connect a backup battery to one of the following: The Servo Drive for the R88D-WT□, the battery cable for the R88D-WN□-ML2, or the Connector Terminal Block.

(2) Do not connect anything to unused terminals.

Terminal Block Wiring Example (XW2B-20G4, XW2B-20G5, and XW2D-20G6)



Note

(1) Use a maximum of 300 mA total for the 24-VDC inputs.

(2) Do not use inputs other than sensor inputs.

Terminal Block Signal Names

Terminal Block

Signal	No.
+24VIN	1
	2
+24VIN	3
	4
+24VIN	5
	6
EXT1	7
DEC	8
NOT	9
POT	10
	11
	12
	13
	14
STOP	15
0GND	16
BKIR	17
	18
/ALM	19
Shield	20

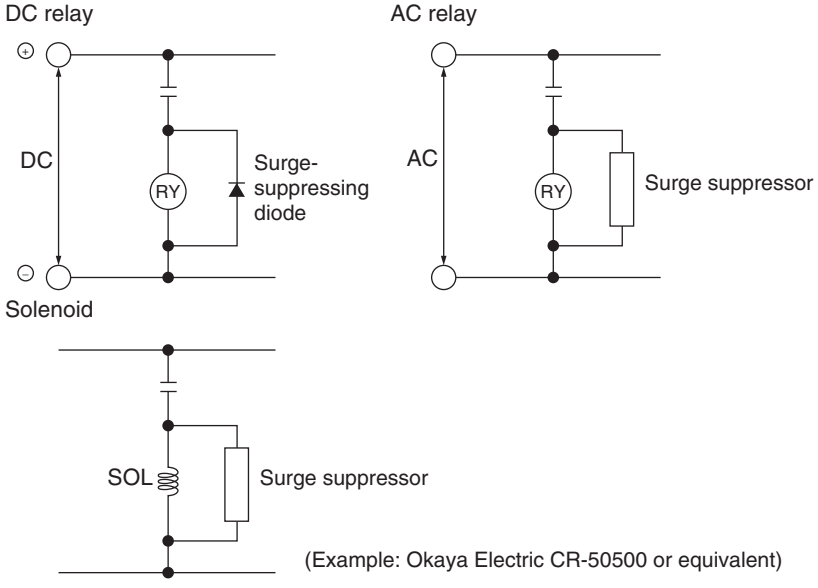
Wiring Precautions

The electronic control devices may malfunction due to noise from nearby power supply lines, external loads, or other sources.

Malfunctions caused by noise can be troublesome because it can be difficult to recreate the situation and to identify the noise source.

Use the following methods to eliminate malfunctions due to noise and improve the system's reliability.

- When selecting wiring components, use wires or cables that meet or exceed the specifications listed in the Servo Drive User's Manual.
- Wire the control lines (communications lines, external I/O signal lines, etc.) separately from the power lines (AC power supply lines and motor power lines). Do not wire these lines together in the same duct or bundle them together.
- Use shielded cables for the control lines.
- Use the specified special cables to connect the PCU and Servo Drives.
- Always connect surge suppressors to nearby inductive loads (relays or solenoids).



(Example: Okaya Electric CR-50500 or equivalent)

Note Connect surge-suppressing diodes or surge suppressors close to relays. Use surge-suppressing diodes with a dielectric strength of at least 5 times the circuit voltage.

- Noise may be transferred through the power line if there is nearby equipment that generates high-frequency noise or the power supply is shared with equipment such as an electric welder or electric discharge equipment. In this case, insert a noise filter in the power supply input line.
- Connect to a ground of 100 Ω or less and use the thickest possible wire, greater than 1.25 mm^2.
- Twisted-pair cable is recommended for power lines.

SECTION 4
Data Areas

This section provides an overview of the parameter and data settings used in Position Control Unit operation and provides information on memory allocations.

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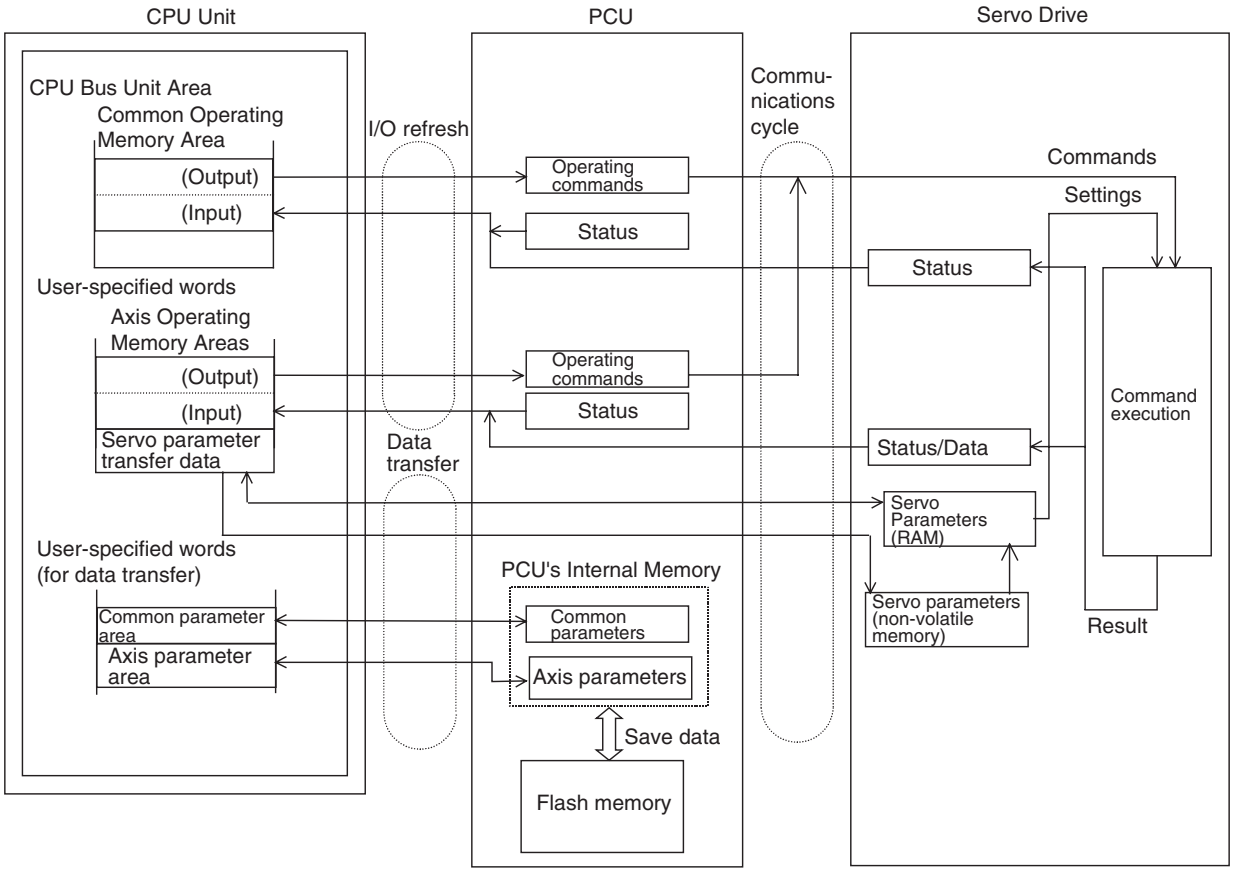
4-1 Overall Structure

The PCU is used by exchanging data with the CPU Unit as shown in the following diagram.



The data handled by the PCU can be classified into the following six types.

Data name	Contents	Setting area	Enable timing
Common Parameter Area	This area contains the parameters for basic setting of PCU operation, such as allocation of the Axis Operating Memory Areas and MECHATROLINK communications. The common parameters must be set to use the PCU.	PCU's internal memory (The parameter settings can be saved in the PCU's flash memory.)	The settings saved in the PCU are enabled when read to the PCU internal memory at power ON or restart.
Axis Parameter Areas	These areas contain the parameters for axis control settings, such as the origin input signal selection and origin search method.	PCU's internal memory (The parameter settings can be saved in the PCU's flash memory.)	The settings saved in the PCU are read to the PCU internal memory at power ON or restart. When the settings are written, they are refreshed immediately and are enabled after they have been written.
Servo Parameter Area	These parameters are for setting Servo Drive operation.	Servo Drive's internal memory (The parameter settings can be saved in the Servo Drive's internal non-volatile memory.)	Online Servo Parameters are enabled as soon as they are written, and offline Servo parameters are enabled after the Servo Drive power is turned OFF and ON again, or after executing DEVICE SETUP.
Common Operating Memory Area	This area is for settings for common PCU operations, such as communications control and transferring common parameters. The status of these operations is also input to this area.	CPU Unit's CPU Bus Unit Area	Data is updated with every I/O refresh of the CPU Unit. The set data is enabled and used with the startup of each operation.
Axis Operating Output Memory Areas	These areas are for settings and operations of axis operation, such as positioning/speed commands and operating commands for direct operation, origin search, and jogging.	CPU Unit's memory area set in the common parameters.	Data is updated with every I/O refresh of the CPU Unit. The set data is enabled and used with the startup of each operation.
Axis Operating Input Memory Areas	These areas are used to input status information for axis operations, such as present position and axis operation status.	CPU Unit's memory area set in the common parameters.	Data is updated with every I/O refresh of the CPU Unit.

Using these data/parameter settings, the PCU executes operation (1) using the operation settings specified in the common parameters, axis parameters, and Servo parameters (2) based on operating commands received from the Axis Operating Memory Areas.

The common parameters, axis parameters, and certain Servo parameters are the basic settings for the PCU and the axes to be controlled. Therefore, these settings must be set when using the PCU. Make the settings for other data/parameters according to the kind of operation required.

PCU Setting Procedure

Step			Operation	Result
1		Set unit number.	Set the unit number on the unit number setting switch and turn ON the power to the PCU.	The Common Operating Memory Area starts from the beginning word obtained using the following equation: n = CIO 1500 + (unit No. × 25)
2		Set common parameters.	Write the common parameters to the PCU and save them in the internal flash memory using the WRITE DATA and SAVE DATA Bits in the Common Operating Memory Area. After saving the common parameters, restart the PCU or cycle the power to enable the parameters.	The axes being used (scan list) and MECHATROLINK communications settings are determined. The Axis Operating Output/Input Memory Areas for the axes to be used are allocated.
3		Set axis parameters.	Write the axis parameters to the PCU and save them in the internal flash memory using the WRITE DATA and SAVE DATA Bits in the Common Operating Memory Area. (These parameters are set at the same time as the common parameters.)	The settings of the origin search operation and other parameters for the axes to be used are determined.
4		Start MECHATROLINK communications.	Start MECHATROLINK communications using the CONNECT Bit in the Common Operating Memory Area.	When MECHATROLINK communications start, the axes are operated according to the bits in the Axis Operating Output Memory Areas and the status of the axes can be monitored using the bits in the Axis Operating Input Memory Areas. Subsequent operations are performed with MECHATROLINK communications in progress.
MECHATROLINK communications in progress	5	Set Servo parameters.	Write the Servo parameters using the WRITE SERVO PARAMETER Bit and SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Areas. Read the Servo parameters using the READ SERVO PARAMETER Bit in the Axis Operating Input Memory Areas.	The settings for each axis or each Servo Parameter are transferred. The transferred online parameters are enabled when writing is completed, and transferred offline parameters are enabled when the Servo Drive power is cycled or DEVICE SETUP is executed.
	6	Operate axes.	Start operating axes using the bits in the Axis Operating Output Memory Areas. Monitor the status of axes using the Axis Operating Input Memory Areas.	Commands are executed and status information is obtained when the PLC's I/O is refreshed.

4-2 Data Areas

The following tables provide the bit/word addresses for the parameters and data handled by the PCU. For further details, refer to the relevant sections.

Only the Servo parameters for applicable models are listed here. For details on Servo parameters, refer to the operation manual for the model being used.

Common Parameter Area

PCU's internal address	Name	Bits			
		15 to 12	11 to 08	07 to 04	03 to 00
1838 hex	Area allocations	Axis Operating Output Memory Area designation			
1839 hex		Beginning word of Axis Operating Output Memory Area			
183A hex		Axis Operating Input Memory Area designation			
183B hex		Beginning word of Axis Operating Input Memory Area			
183C hex	Scan list	Axis 2 allocation		Axis 1 allocation	
183D hex		Axis 4 allocation		Axis 3 allocation	
183E hex		Axis 6 allocation		Axis 5 allocation	
183F hex		Axis 8 allocation		Axis 7 allocation	
1840 hex		Axis 10 allocation		Axis 9 allocation	
1841 hex		Axis 12 allocation		Axis 11 allocation	
1842 hex		Axis 14 allocation		Axis 13 allocation	
1843 hex		Axis 16 allocation		Axis 15 allocation	
1844 hex to 1855 hex	Reserved by the system.	Set to 0000.			
1856 hex	MECHATROLINK communications setting	Transfer cycle		Communications cycle	
1857 hex		00 (fixed)		C2 master connection	Number of communications retries
1858 hex to 185F hex	Reserved by the system.	Set to 0000.			

Axis Parameter Area

PCU's internal address	Name		Bits			
			15 to 12	11 to 08	07 to 04	03 to 00
1860 hex	Axis 1	Input signal selection	Origin input signal selection		Interrupt input signal selection	
1861 hex		Operation mode selection	Origin search direction Origin search preset	Origin detection method	Origin search operation	0 (fixed)
1862 hex			0 (fixed)	0 (fixed)	0 (fixed)	Encoder type
1863 hex to 1873 hex		Reserved by the system.	Set to 0000.			
1874 hex	Axis 2	Input signal selection	Origin input signal selection		Interrupt input signal selection	
1875 hex		Operation mode selection	Origin search direction Origin search preset	Origin detection method	Origin search operation	0 (fixed)
1876 hex			0 (fixed)	0 (fixed)	0 (fixed)	Encoder type
1877 hex to 1887 hex		Reserved by the system.	Set to 0000.			
1888 hex to 189B hex	Axis 3	Same as above	Same as above			

PCU's internal address	Name		Bits			
			15 to 12	11 to 08	07 to 04	03 to 00
189C hex to 18AF hex	Axis 4	Same as above	Same as above			
18B0 hex to 18C3 hex	Axis 5	Same as above	Same as above			
18C4 hex to 18D7 hex	Axis 6	Same as above	Same as above			
18D8 hex to 18EB hex	Axis 7	Same as above	Same as above			
18EC hex to 18FF hex	Axis 8	Same as above	Same as above			
1900 hex to 1913 hex	Axis 9	Same as above	Same as above			
1914 hex to 1927 hex	Axis 10	Same as above	Same as above			
1928 hex to 193B hex	Axis 11	Same as above	Same as above			
193C hex to 194F hex	Axis 12	Same as above	Same as above			
1950 hex to 1963 hex	Axis 13	Same as above	Same as above			
1964 hex to 1977 hex	Axis 14	Same as above	Same as above			
1978 hex to 198B hex	Axis 15	Same as above	Same as above			
198C hex	Axis 16	Input signal selection	Origin input signal selection		Interrupt input signal selection	
198D hex		Operation mode selection	Origin search direction Origin search preset	Origin detection method	Origin search operation	0 (fixed)
198E hex			0 (fixed)	0 (fixed)	0 (fixed)	Encoder type
198F hex to 199F hex		Reserved by the system.	Set to 0000.			

Servo Parameter Area

The following table provides information on the parameters for the main functions of the PCU that are described in this manual when using an R88D-WT□ OMRON W-series Servo Drive together with a JUSP-NS115 MECHATROLINK-II Application Module or an R88D-WN□-ML2 W-series Servo Drive with built-in MECHATROLINK-II communications. A list of other parameters, OMRON G-series Servo Drive parameters, and SMARTSTEP Junior Servo Drive parameters are provided in *4-5 Servo Parameter Area*. For further details on each of the parameters, refer to the operation manuals for OMRON G-series Servo Drives, OMRON W-series Servo Drives, SMARTSTEP Junior Servo Drives, and Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.

The default settings for parameters Pn000 to Pn601 in the parameter tables for the R88D-WT□ W-series Servo Drive used with the JUSP-NS115 are automatically set to the default parameter settings used when the JUSP-NS115 MECHATROLINK-II Application Module is mounted to a W-series Servo Drive. Parameters from Pn800 onwards are enabled when the JUSP-NS115 is installed. The parameter names and default settings used for these parameters follow those specified in the JUSP-NS115 operation manual.

For details on information provided in the Enable Setting and Details columns, refer to *4-5 Servo Parameter Area*.

Function Selection Parameters

■ **R88D-WT□ and R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn001	Function selection application switch 1	2	0	Select stop if an alarm occurs when Servomotor is OFF	0	Servomotor stopped by dynamic brake.	2	---	---	Offline	---
					1	Dynamic brake OFF after Servomotor stopped.		---	---		
					2	Servomotor stopped with free run.		---	---		
			1	Select stop when prohibited drive is input	0	Stop according to Pn001.0 settings (release Servomotor after stopping)	0	---	---	Offline	---
					1	Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping.		---	---		
					2	Stop Servomotor using torque set in Pn406, and release Servomotor after stopping.		---	---		
			2	Select AC/DC power input	---	---	0	---	---	Offline	---
			3	Select warning code output	---	---	1	---	---	Offline	---
Pn002	Function selection application switch 2	2	0	Torque command input change (during speed control)	0	Option command values not used.	0	---	---	Offline	---
					1	Option command value 1 used as the torque limit input.					
					2	Option command value 1 used as the torque feed forward input.					
					3	Option command values 1 and 2 used as the torque limit input according to the forward/reverse rotation current limit setting.					
			1	Speed command input change (during torque control)	0	Option command value not used.	0	---	---	Offline	---
					1	Option command value 1 used as speed limit input.					
			2	Operation switch when using absolute encoder	0	Use as absolute encoder.	0	---	---	Offline	---
					1	Use as incremental encoder.					
			3	Fully-closed encoder usage method	---	---	0	---	---	Offline	---

Position Control Parameters

■ **R88D-WT□**

Parameter No.	Parameter name	Parameter size	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn202	Electronic gear ratio G1 (numerator)	2	Set the pulse rate for the command pulses and Servomotor travel distance. 0.01 ≤ G1/G2 ≤ 100	4	---	1 to 65535	Offline	---
Pn203	Electronic gear ratio G2 (denominator)	2		1	---	1 to 65535	Offline	---

■ **R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn20E	Electronic gear ratio G1 (numerator)	4	Sets the pulse rate for the command pulses and Servomotor movement distance. 0.01 ≤ G1/G2 ≤ 1000	4	---	1 to 1073741824	Offline	---
Pn210	Electronic gear ratio G2 (denominator)	4		1	---	1 to 1073741824	Offline	---

Speed Control Parameters

■ **R88D-WT□ and R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn305	Soft start acceleration time	2	Sets acceleration time during speed control soft start.	0	ms	0 to 10000	Online	---
Pn306	Soft start deceleration time	2	Sets deceleration time during speed control soft start.	0	ms	0 to 10000	Online	---

Torque Control (Torque Limit) Parameters

■ **R88D-WT□ and R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn402	Forward torque limit	2	Forward rotation output torque limit (rated torque ratio).	350	%	0 to 800	Online	---
Pn403	Reverse torque limit	2	Reverse rotation output torque limit (rated torque ratio).	350	%	0 to 800	Online	---
Pn404	Forward rotation external current limit	2	Output torque limit during input of forward rotation current limit (rated torque ratio).	100	%	0 to 800	Online	---
Pn405	Reverse rotation external current limit	2	Output torque limit during input of reverse rotation current limit (rated torque ratio).	100	%	0 to 800	Online	---
Pn406	Emergency stop torque	2	Deceleration torque when an error occurs (rated torque ratio).	350	%	0 to 800	Online	---
Pn407	Speed limit	2	Sets the speed limit in torque control mode.	3000	r/min	0 to 10000	Online	---

I/O and Status Parameters

■ **R88D-WT□**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn500	Positioning completion range 1	2	Sets the range of positioning completed.				3	Command unit	0 to 250	Online	---
Pn502	Rotation speed for motor rotation detection	2	Sets the rotation speed for the Servomotor rotation detection output (TGON).				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag.				10	r/min	0 to 100	Online	---
Pn504	Positioning completion range 2	2	Sets the proximity range for the Positioning Proximity Flag.				3	Command unit	1 to 250	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selection 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	POT (forward drive prohibited input) signal Input terminal allocation	0	Allocated to CN1, pin 40: Valid for low input	8	---	---	Offline	Standard setting: 2
					1	Allocated to CN1, pin 41: Valid for low input					
					2	Allocated to CN1, pin 42: Valid for low input					
					3	Allocated to CN1, pin 43: Valid for low input					
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always valid.					
					8	Always invalid.					
					9	Allocated to CN1, pin 40: Valid for high input					
					A	Allocated to CN1, pin 41: Valid for high input					
					B	Allocated to CN1, pin 42: Valid for high input					
					C	Allocated to CN1, pin 43: Valid for high input					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50B	Input signal selection 2	2	0	NOT (reverse drive prohibited) signal input terminal allocation	0 to F	Same as Pn50A.3	8	---	---	Offline	Standard setting: 3
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	PCL (forward rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	5	---	---	Offline	Fixed setting: 8
			3	NCL (reverse rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	6	---	---	Offline	Fixed setting: 8
Pn50E	Output signal selection 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	Not used.	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pins 25, 26					
					2	Allocated to CN1, pins 27, 28					
					3	Allocated to CN1, pins 29, 30					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0	1	---	---	Offline	Standard setting: 0
			2	TGON (Servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	2	---	---	Offline	Standard setting: 0
			3	READY (Servomotor warmup complete) signal output terminal allocation	0 to 3	Same as Pn50E.0	3	---	---	Offline	Standard setting: 3
Pn50F	Output signal selection 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 2
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn510	Output signal selection 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn511	Input signal selection 5	2	0	DEC (origin return deceleration limit switch) signal input terminal allocation	0 to F	Same as Pn50A.3	8	---	---	Offline	Standard setting: 1
			1	EXT1 (external latch 1 input) signal input terminal allocation	0 to F	Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.)	8	---	---	Offline	Standard setting: 4
			2	EXT2 (external latch 2 input) signal input terminal allocation	0 to F	Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.)	8	---	---	Offline	Standard setting: 5
			3	EXT3 (external latch 3 input) signal input terminal allocation	0 to F	Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.)	8	---	---	Offline	Standard setting: 6

■ **R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn502	Rotation speed for motor rotation detection	2	Sets the number of rotations for the Servomotor rotation detection output (TGON).				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP).				10	r/min	0 to 100	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selections 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	POT (forward drive prohibited input) signal Input terminal allocation	0	Allocated to CN1, pin 13: Valid for low input	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pin 7: Valid for low input					
					2	Allocated to CN1, pin 8: Valid for low input					
					3	Allocated to CN1, pin 9: Valid for low input					
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 13: Valid for high input					
					A	Allocated to CN1, pin 7: Valid for high input					
					B	Allocated to CN1, pin 8: Valid for high input					
					C	Allocated to CN1, pin 9: Valid for high input					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					
Pn50B	Input signal selections 2	2	0	NOT (reverse drive prohibited input) signal Input terminal allocation	0 to F	Same as Pn50A.3.	2	---	---	Offline	Standard setting: 2
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50E	Output signal selections 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	Not used.	0	---	---	Offline	Standard setting: 0
					1	Allocated to CN1 pins 1, 2					
					2	Allocated to CN1 pins 23, 24					
					3	Allocated to CN1 pins 25, 26					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
			2	TGON (servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
			3	READY (servo ready) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
Pn50F	Output signal selections 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0.	1	---	---	Offline	Standard setting: 1
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	Standard setting: 0
Pn510	Output signal selections 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0.	0	---	---	Offline	---
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn511	Input signal selections 5	2	0	DEC signal input terminal allocation	0 to F	Same as Pn50A.3.	3	---	---	Offline	Standard setting: 3
			1	EXT1 signal input terminal allocation	0 to F	Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.)	4	---	---	Offline	Standard setting: 4
			2	EXT2 signal input terminal allocation	0 to F	Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.)	5	---	---	Offline	Standard setting: 5
			3	EXT3 signal input terminal allocation	0 to F	Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.)	6	---	---	Offline	Standard setting: 6

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn522	Positioning completed range 1	4	Setting range for positioning completed range				3	Command unit	0 to 1,073,741,824	Online	---
Pn524	Positioning completed range 2	4	Setting for proximity range for the Positioning Proximity Flag.				3	Command unit	1 to 1,073,741,824	Online	---

Control Function Parameters

■ **R88D-WT□ and R88D-WN□-ML2)**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	MECHATROLINK-II communications check mask	0	Detects both communications errors (A.E6) and synchronization errors (A.E5).	0	---	---	Online	Always set to 0.
					1	Ignores communications errors (A.E6).					
					2	Ignores synchronization errors (A.E5).					
					3	Ignores both communications errors (A.E6) and synchronization errors (A.E5).					
			1	Warning check mask	0	Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameter setting warnings (A.94).					
					2	Ignores MECHATROLINK-II command warnings (A.95).					
					3	Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95).					
					4	Ignores communications errors (A.96).					
					5	Ignores both parameter setting warnings (A.94) and communications errors (A.96).					
					6	Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96).					
					7	Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96).					
			2	Communications error count at single transmission	---	---	0	---	---	Online	---
			3	Not used.	---	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Function selection application (software limits)	2	0	Software limit function	0	Software limit enabled.	(See note.)	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Software limit disabled in both directions.					
			1	Not used.	---	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using references	0	No software limit check using references.	0	---	---	Online	Always set to 0.
					1	Software limit check using references.					
			3	Not used.	---	(Do not change the setting.)	0	---	---	---	---

Note R88D-WT□ with JUSP-NS115: 0
R88D-WN□-ML2: 3

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn803	Zero point width	2	Sets the detection range for the Origin Stop Flag.	10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the forward software limit.	819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the reverse software limit.	−819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn808	Absolute encoder zero point position offset	4	Sets the offset for the mechanical origin from the absolute encoder's absolute value data.	0	Command unit	−1,073,741,823 to 1,073,741,823	Offline	---
Pn80A	First-step linear acceleration constant	2	Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80B	Second-step linear acceleration constant	2	Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80C	Acceleration constant switching speed	2	Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn80D	First-step linear deceleration constant	2	Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Second-step linear deceleration constant	2	Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80F	Deceleration constant switching speed	2	Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn810	Exponential acceleration/ deceleration bias	2	Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control.	0	Command units/s	0 to 32767	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn811	Exponential acceleration/ deceleration time constant	2	Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn812	Movement average time	2	Sets the S-curve acceleration/deceleration moving average time for the acceleration/deceleration curve used in position control.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn814	Final travel distance for external positioning	4	Sets the final travel distance for external positioning when performing interrupt feeding using direct operation.	100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode setting	2	0	Zero point return direction	0	Forward	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse					
			1 to 3	Not used.	---	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search.				100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Note The parameters for backlash compensation are different for the R88D-WT□ and R88D-WN□-ML2.

■ **R88D-WT□**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn81B	Backlash compensation amount	2	Sets the amount of backlash compensation.				0	×0.1 command unit	−32,768 to 32,767	Online	---
Pn81D	Compensation function selection	2	0	Backlash compensation selection	0	Compensates in forward direction.	0	---	---	Offline	---
					1	Compensates in reverse direction.					
			1 to 3	Not used.	---	(Do not change the setting.)	0	---	---	---	---

■ **R88D-WN□-ML2**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn207	Position control settings 2	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Backlash compensation selection	0	Disabled	0	---	---	Offline	---
					1	Compensates to forward rotation side.					
					2	Compensates to reverse rotation side.					
			3	INP 1 output timing	---	---	0	---	---	Offline	---
Pn214	Backlash compensation amount	2	Mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven)				0	Command unit	–32767 to 32767	Online	---
Pn215	Backlash compensation time constant	2	Sets the backlash compensation time constant.				0	× 0.01 ms	0 to 65535	Online	---

Common Operating Memory Area

Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)

Word	Name															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
n	Not used (reserved by the system).												SAVE DATA	READ DATA	WRITE DATA	UNIT ERROR RESET
n+1	REJOIN (See note.)	Not used (reserved by the system).							READ BACK-UP DATA	WRITE BACK-UP DATA	Reserved by the system.					CONNECT
n+2	Axes to connect (See note.)															
n+3 to n+5	Not used (reserved by the system).															
n+6	Number of write words															
n+7	Write source area															
n+8	Write source word															
n+9	Write destination address															
n+10	Number of read words															
n+11	Read source address															
n+12	Read destination area															
n+13	Read destination word															
n+14	Not used (reserved by the system).															
n+15	Not used (reserved by the system).	Data Transferring Flag	Not used (reserved by the system).	Unit Error Flag	Not used (reserved by the system).											
n+16	Connection Status Flag	Unit Busy Flag	Not used (reserved by the system).	Memory Card transfer error	Reserved by the system.											
n+17 to n+20	Reserved by the system.															
n+21	Unit error code															

Word	Name															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
n+22	Axis communications status															
n+23 n+24	Not used (reserved by the system).															

Note The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.

Axis Operating Output Memory Areas

Beginning Word of Axis Operating Output Memory Areas:
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Word	Name															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
a	DECELERATION STOP	Override Enable Bit	DEVIATION COUNTER RESET (See note 4.)	ERROR RESET	Not used (reserved by the system).	Direction designation	JOG	PRESENT POSITION PRESET	ORIGIN RETURN	ORIGIN SEARCH	INTERRUPT FEEDING	RELATIVE MOVEMENT	ABSOLUTE MOVEMENT	Not used (reserved by the system).	LINEAR INTERPOLATION START (See note 1.)	LINEAR INTERPOLATION SETTING (See note 1.)
a+1	EMERGENCY STOP	SAVE SERVO PARAMETER	READ SERVO PARAMETER	WRITE SERVO PARAMETER	DEVICE SETUP	Not used (reserved by the system).							TORQUE CONTROL	SPEED CONTROL	SERVO UNLOCK	SERVO LOCK
a+2	Position command value															
a+3																
a+4	Speed command value (for position control)															
a+5																
a+6	Speed command value (for speed control)															
a+7																
a+8	Torque command value															
a+9																
a+10	Option command value 1															
a+11																
a+12	Option command value 2															
a+13																
a+14	Override															
a+15	Not used (reserved by the system).								Monitor 2 type				Monitor 1 type			
a+16	Reverse rotation current limit	Forward rotation current limit	Reserved by the system.									S-curve designation	Exponential curve designation	Reserved by the system.		
a+17	Servo Parameter No.															
a+18	Parameter size															
a+19	Write data (Servo Parameters)															
a+20																
a+21	Not used (reserved by the system).								Interpolation axis designation (See note 3.)				Interpolation axis designation (See note 2.)			
a+22	Not used (reserved by the system).								Interpolation position designation (See note 3.)				Interpolation position designation (See note 2.)			
a+23	Interpolation speed command value (See note 1.)															
a+24																

Note

(1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit version 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.

Axis Operating Input Memory Areas

Beginning Word of Axis Operating Input Memory Areas:
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Word	Name															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
b	Axis Control Status Flags															
	Stop Execution Flag	Servo Parameters Transferring Flag	Busy Flag	Error Flag	Warning Flag	Not used (reserved by the system).			Origin Stop Flag	No Origin Flag	PCU Positioning Completed Flag	Not used (reserved by the system).				Receiving Command Flag
b+1	Servo Status Flags (status particular to Servo Drive)															
	Reserved by the system.		Reverse Software Limit Flag	Forward Software Limit Flag	Positioning Proximity Flag/ Speed Limit Status Flag	Reserved by the system.	Torque Limit Status Flag	Distribution Completed Flag/ Zero Speed Flag	Position Completed Flag/ Speed Conformity Flag	Reserved by the system.		Main Power ON Flag	Servo ON Flag	Reserved by the system.		
b+2	Reserved by the system.															
b+3	External I/O Status Bits															
	Reserved by the system.					Emergency stop input (See note 2.)	Brake output	External latch signal 3 input	External latch signal 2 input	External latch signal 1 input	Encoder Phase Z input	Encoder Phase B input	Encoder Phase A input	Origin proximity input signal	Reverse rotation limit input	Forward rotation limit input
b+4	Axis error code															
b+5	Not used (reserved by the system).								Monitor 2 type				Monitor 1 type			
b+6	Feedback present position															
b+7																
b+8	Command present position															
b+9																
b+10	Monitor 1															
b+11																
b+12	Monitor 2															
b+13																
b+14	Read data (Servo Parameters)															
b+15																
b+16 to b+23	Not used (reserved by the system).															
b+24	Not used (reserved by the system).		Linear interpolation executing (See note 1.)	Not used (reserved by the system).												Linear interpolation setting completed (See note 1.)

Note

(1) Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) The emergency stop input status is input only for SMARTSTEP Junior Servo Drives. This status is not used (reserved by the system) by W-series Servo Drives.

4-3 Common Parameter Area

Common Parameters are used for basic settings for operating the PCU, such as allocation of the Axis Operating Memory Areas and settings for MECHATROLINK communications. The common parameters must be set when using the PCU.

4-3-1 Common Parameters Overview

Common Parameters are transferred to the PCU's internal memory using the data transfer command and saved in the PCU's flash memory using the SAVE DATA command. After setting and saving the Common Parameters, either cycle the power to the CPU Unit, or restart the PCU. This operation will enable the set parameters. The Common Parameter Area is used to set the following information.

PCU's address	Contents		Setting
	Bits 08 to 15	Bits 00 to 07	
1838 hex	Axis Operating Output Memory Area designation		Specifies the area allocated for the Axis Operating Output Memory Areas. 0000 hex: No setting 00B0 hex: CIO Area 00B1 hex: Work Area 00B2 hex: Holding Area 00B3 hex: Auxiliary Area 0082 hex: DM Area 0050 to 0059, 005A, 005B, 005C hex: EM Area (5□: □ = EM Bank No.)
1839 hex	Beginning word of Axis Operating Output Memory Areas		Specifies the beginning word of the Axis Operating Output Memory Areas. The beginning word of the Operating Output Memory Area for Axis 1 is determined by the Axis Operating Output Memory Area designation and the word determined using this parameter. Each Axis is allocated 25 words in sequence from this word.
183A hex	Axis Operating Input Memory Area designation		Specifies the allocated area and beginning word for the Axis Operating Input Memory Areas. The setting method is the same as for the Axis Operating Output Memory Areas.
183B hex	Beginning word of Axis Operating Input Memory Areas		
183C hex to 1843 hex	Scan list		Sets the axis allocations for axes 1 to 16 with 8 bytes per axis, as follows: 00 hex: Axis not used (default setting) 40 hex: Allocates axis to the Servo Drive.
1856 hex	Transfer cycle	Communications cycle	Transfer cycle: 00 hex: 1 ms (default setting) 01 hex: 1 ms 02 hex: 2 ms 03 hex: 3 ms 04 hex: 4 ms 05 hex: 5 ms 06 hex: 6 ms 07 hex: 7 ms 08 hex: 8 ms A2 hex: 0.25 ms A5 hex: 0.5 ms Communications cycle: Sets a multiplier used to obtain integer multiples of the transfer cycle. Set value: 00 to 20 hex The default setting 00 is the same as when the cycle is set to 3. Set as follows: Transfer cycle x communications cycle (multiplier) ≤ 32 ms

PCU's address	Contents			Setting
	Bits 08 to 15	Bits 00 to 07		
1857 hex	00 (fixed)	07 to 04	03 to 00	C2 master connection: 0: No C2 master (default setting) 1: C2 master connected Number of communications retries: Set value: 0 to 7, F The default setting 0 is the same as when the number of retries is set to 1.
		C2 master connection	Number of communications retries	

4-3-2 Common Parameter Details

The data set in the Common Parameter Area is as follows:

Unit address	Name	Enable timing
1838 hex	Axis Operating Output Memory Area designation	At powerup or restart.
1839 hex	Beginning word of Axis Operating Output Memory Areas	
183A hex	Axis Operating Input Memory Area designation	
183B hex	Beginning word of Axis Operating Input Memory Areas	

Data configuration	15 08 07 00	Data setting range	Default
1838 hex	Axis Operating Output Memory Area designation	00B0 to 00B3, 0082, 0050 to 005C hex	0000
1839 hex	Beginning word of Axis Operating Output Memory Areas	0000 to 7FFF hex	0000
183A hex	Axis Operating Input Memory Area designation	00B0 to 00B3, 0082, 0050 to 005C hex	0000
183B hex	Beginning word of Axis Operating Input Memory Areas	0000 to 7FFF hex	0000

Data Details

Axis Operating Output Memory Area Designation

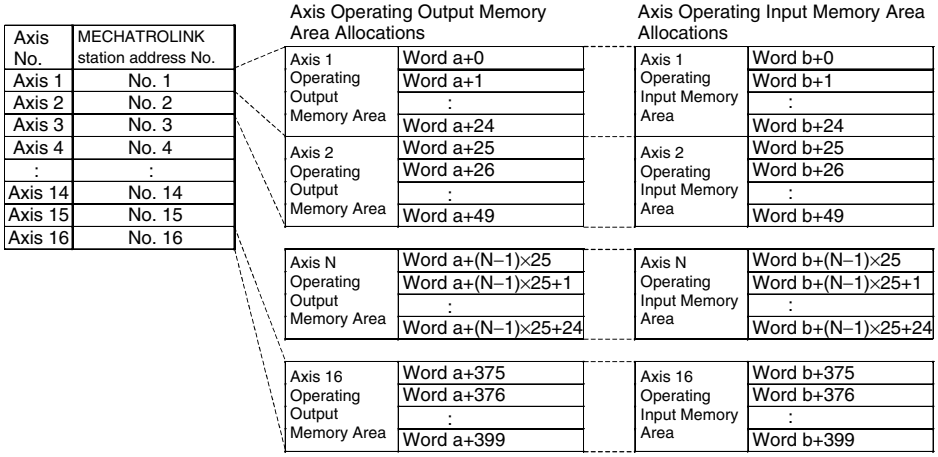
Specifies the words allocated for the Axis Operating Output Memory Areas.

0000 hex: No setting (default setting)
00B0 hex: CIO Area
00B1 hex: Work Area
00B2 hex: Holding Area
00B3 hex: Auxiliary Area
0082 hex: DM Area
0050 to 0059, 005A, 005B, 005C hex:
EM Area (005□ hex: □ = EM Bank No.)

Beginning Word of Axis Operating Output Memory Areas

Specifies the beginning word of the Axis Operating Output Memory Areas.

The Axis Operating Output Memory Area designation and the word determined using this parameter are used as the beginning word of the Operating Output Memory Area for Axis 1. Each axis is allocated 25 words in sequence up to the highest axis number registered in the scan list.



a: Beginning word of Axis Operating Output Memory Areas specified in Common Parameters.
b: Beginning word of Axis Operating Input Memory Areas specified in Common Parameters.

Axis Operating Input Memory Area Designation:

Specifies the words allocated for the Axis Operating Input Memory Areas.

The setting method is the same as for the Axis Operating Output Memory Areas.

Beginning Word of Axis Operating Input Memory Areas:

Specifies the beginning word of the Axis Operating Input Memory Areas.

The setting method is the same as for the Axis Operating Output Memory Areas.

Note

(1) Set the beginning word of the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas in the Common Parameters so that the words allocated to each area do not exceed the upper limit of the range for each of the CPU Unit's I/O memory areas.
CPU Unit I/O Memory Areas
CIO Area: CIO 0000 to CIO 6143
Work Area: W000 to W511
Holding Area: H000 to H511
Auxiliary Area: A000 to A959
DM Area: D00000 to D32767
EM Area: E□_00000 to E□_32767 (□ = EM Bank No.)
The maximum set value for the beginning word of the Axis Operating Output/Input Memory Area is calculated as follows:
Maximum number of words in each area − Highest axis No. registered in scan list × 25 + 1

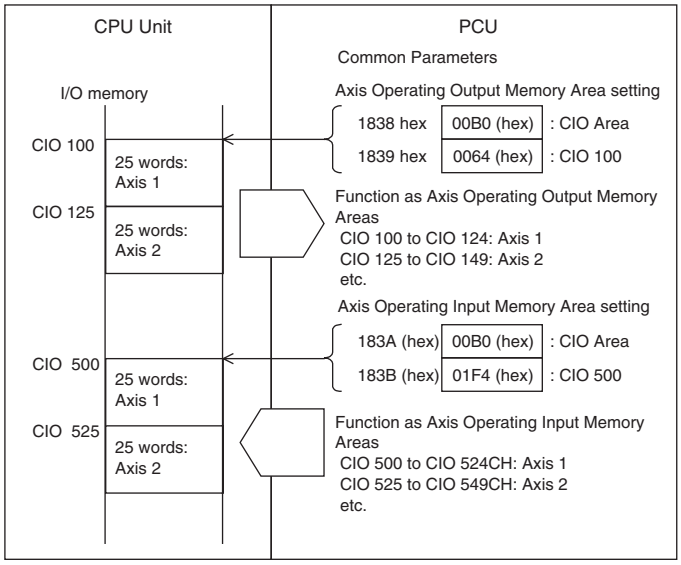
(2) If the setting exceeds the range of the I/O memory area, an Initialization Common Parameter Check Error (Unit error code 0028) will occur when the PCU power is turned ON or the Unit is restarted.
Example:
Beginning word of the Axis Operating Output Memory Area: CIO 6100
Connected axes: 2 min.
Axis 1: Output Area: CIO 6100 to CIO 6124
Axis 2: Output Area: CIO 6125 to CIO 6149
The highest word in the CIO Area is CIO 6143. Therefore, an error will occur.

(3) If the ranges set for the Axis Operating Output Memory Area and Axis Operating Input Memory Area overlap, an Initialization Common Parameter

Check Error (Unit error code 0028) will occur when the PCU power is turned ON or the Unit is restarted.

(4) Do not set the bank number of the EM Area that is being saved to file memory in the CPU Unit. When the EM Area for the bank saved to file memory has been specified, the information in the Operating Data Area will not be reflected, resulting in a malfunction. If multiple PCUs are mounted to a single PLC, make sure that the Operating Data Areas do not overlap. The PCU will not detect an error if the Operating Data Areas overlap, which may result in a malfunction.

Setting Example



Details

Refer to *6-2-2 Scan List and PCU Area Allocations*.

Unit address	Name	Enable timing
183C hex to 1843 hex	Scan list	At powerup or restart.

Data configuration	15 08 07 00	Data setting range	Default
183C hex	Axis 2 allocation | Axis 1 allocation	00 or 40	0000
183D hex	Axis 4 allocation | Axis 3 allocation	00 or 40	0000
183E hex	Axis 6 allocation | Axis 5 allocation	00 or 40	0000
183F hex	Axis 8 allocation | Axis 7 allocation	00 or 40	0000
1840 hex	Axis 10 allocation | Axis 9 allocation	00 or 40	0000
1841 hex	Axis 12 allocation | Axis 11 allocation	00 or 40	0000
1842 hex	Axis 14 allocation | Axis 13 allocation	00 or 40	0000
1843 hex	Axis 16 allocation | Axis 15 allocation	00 or 40	0000

Data Details

Set the allocations for the MECHATROLINK devices connected to the PCU.

Make the following settings using eight bits per axis for axes 1 to 16.
00 hex: Axis not used (no allocation).
40 hex: Axis allocated to the Servo Drive.

Up to 16 axes can be allocated for the CS1W/CJ1W-NCF71, up to 2 axes can be allocated for the CS1W/CJ1W-NC271, and up to 4 axes can be allocated for the CS1W/CJ1W-NC471. An error will occur if you allocate more axes than your Unit supports.

Setting Example

In this example, axes 1 to 3, axis 5, and axis 8 are allocated to the Servo Drive. (The axis number corresponds to the station number for the MECHATROLINK device.)

183C hex: 4040 hex
183D hex: 0040 hex
183E hex: 0040 hex
183F hex: 4000 hex
1840 to 1843 hex: 0000 hex

Details

Refer to *6-2-1 Scan List*.

Unit address	Name	Enable timing
1856 hex to 1857 hex	MECHATROLINK communications setting	At Powerup or restart

Data configuration	15 08 07 04 03 00	Data setting range	Default
1856 hex	Transfer cycle | Communications cycle	Transfer cycle: 00 to 08, A2, A5 Communications cycle: 00 to 20 hex	0000
1857 hex	00 (fixed) | C2 master connection | No. of communications retries	C2 master connection: 0, 1 No. of communications retries: 0 to 7, F	0000

Data Details

This parameter is used to make the settings for MECHATROLINK communications. For details on settings, refer to *6-2-3 MECHATROLINK Communications Settings*.

Transfer Cycle

This parameter is used to set the cycle for sending and receiving data with MECHATROLINK communications.

00: 1 ms (default setting)

01: 1 ms	05: 5 ms
02: 2 ms	06: 6 ms
03: 3 ms	07: 7 ms
04: 4 ms	08: 8 ms
A2 hex: 0.25 ms	A5 hex: 0.5 ms

Communications Cycle

This parameter sets the cycle for refreshing data in the PCU and MECHATROLINK device. The communications cycle is set in the Common Parameters by setting the factor used to obtain integer multiples of the transfer cycle.

Set value: 00 to 20 hex

The default setting 00 is the same as when the cycle is set to 3. The communications cycle, however, is set as follows:
Transfer cycle $\times$ communications cycle (multiplier) $\leq$ 32 ms

Number of Communications Retries

This parameter is used to set the maximum number of stations that will perform communications retries when sending/receiving data between the PCU and MECHATROLINK devices.

Set value: 0 to 7, F

The default setting 0 is the same as when the number of retries is set to 1. When F is specified, the number of retires is 0 (no retries).

C2 Master Connection

This parameter is used to set whether a separate communications master is connected to the PCU for MECHATROLINK system support. This parameter will be used for connecting future system support devices. Do not change the default setting of 0 (no C2 master).

0: No C2 master (default setting)
1: C2 master connected

Setting Example

Default Settings

1856 hex: 0000 hex
1857 hex: 0000 hex

The MECHATROLINK communications settings are as follows:

Transfer cycle: 1.0 ms
Communications cycle: × 3 (1.0 ms × 3 = 3.0 ms)
Number of communications retries: 1
There is no C2 master.

Details

Refer to *6-2-3 MECHATROLINK Communications Settings*.

4-4 Axis Parameter Area

The Axis Parameter Area is used to make settings for axis control, such as origin input signal selection and origin search method. The axis parameters for the axes to be used must be set.

4-4-1 Axis Parameters Overview

Axis Parameters are transferred to the PCU's internal memory using the data transfer command and saved in the PCU's flash memory using the SAVE DATA command. Turn ON the power to the CPU Unit again, or restart the PCU to read the Axis Parameters saved in flash memory to the PCU's internal memory.

The Axis Parameters can be changed at any time by sending the WRITE DATA command to the PCU. The changed parameters are enabled as soon as the data has been written without any errors. The addresses in the PCU's internal memory allocated for Axis Parameters are determined by the axis number of each axis using the following equation.

Beginning word of Axis Parameter Area for Axis N: d = 1860 hex + (N–1) × 14 hex (N = 1 to 16)

The following table lists the beginning word of each Axis Parameter Area.

Axis No.	Beginning word d	Axis No.	Beginning word d	Axis No.	Beginning word d	Axis No.	Beginning word d
Axis 1	1860 hex	Axis 5	18B0 hex	Axis 9	1900 hex	Axis 13	1950 hex
Axis 2	1874 hex	Axis 6	18C4 hex	Axis 10	1914 hex	Axis 14	1964 hex
Axis 3	1888 hex	Axis 7	18D8 hex	Axis 11	1928 hex	Axis 15	1978 hex
Axis 4	189C hex	Axis 8	18EC hex	Axis 12	193C hex	Axis 16	198C hex

PCU's address	Contents						Setting
	15 to 14	13	12	11 to 08	07 to 04	03 to 00	
d	Origin input signal selection				Interrupt input signal selection		Select the origin input signal and interrupt input signal. 00: Phase Z (default setting) 01: External latch signal 1 input 02: External latch signal 2 input 03: External latch signal 3 input
d+1	0 (fixed)	Origin search preset	Origin search direction	Origin detection method	Origin search operation	0 (fixed)	Set the origin search operation. Origin search direction 0: Reversal mode 1 (default setting) 1: Reverse mode 2 2: Single-direction mode 3: Reversal mode 3 (See note.) Origin detection method (See note.) 0: With origin proximity input signal reversal (default setting) 1: Without origin proximity input signal reversal 2: Not use origin proximity input signal Origin search direction 0: Forward (default setting) 1: Reverse Origin search preset (See note.) 0: Not Set (default setting) 1: Set
d+2	0 (fixed)			0 (fixed)	0 (fixed)	Encoder type	0: Incremental encoder (default setting) 1: Absolute encoder

Note The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

For details on transferring data, refer to *SECTION 5 Transferring and Saving Data*.

4-4-2 Axis Parameter Details

The data set in the Axis Parameter Area is as follows:
d = 1860 hex + (Axis No. −1) × 14 hex

Unit address	Name	Enable timing
d	Input signal selection	After completion of data writing

Data configuration	15 08 07 00	Data setting range	Default
d	Origin input signal selection / Interrupt input signal selection	Origin input signal selection: 00 to 03 Interrupt input signal selection: 00 to 03	0000

Data Details

Origin Input Signal Selection

Use this parameter to select the origin input signal to be used with origin search.

00: Phase Z
01: External latch signal 1 input
02: External latch signal 2 input
03: External latch signal 3 input

Interrupt Input Signal Selection

Select the interrupt input signal used for interrupt feeding.

00: Phase Z
01: External latch signal 1 input
02: External latch signal 2 input
03: External latch signal 3 input

Note

(1) When 01, 02, or 03 (external latch signals 1 to 3) is selected in the origin input signal selection/interrupt input signal selection, the external latch signal to be used must be allocated in the Servo Drive's external input allocations. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

(2) When using a SMARTSTEP Junior Servo Drive, only 00 (phase Z) and 01 (external latch signal 1) can be used for the origin input signal selection and interrupt input signal selection. Do not select any other input signals.

Setting Example

In this example, the origin search is performed using the Servomotor's phase Z as the origin input, and external latch signal 2 as the interrupt input signal for interrupt feeding.

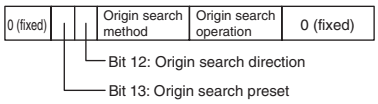
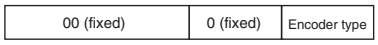
Beginning word of Axis Parameter Area for axis 4:
d = 1860 hex + (4 − 1) × 14 hex = 189C hex
189C hex: 0002 hex = Origin input signal selection: Phase Z (00 hex); Interrupt input signal selection: External latch signal 2 (02 hex)

Details

Refer to *8-2 Origin Search Operation*, and *9-5 Interrupt Feeding*.

d = 1860 hex + (Axis No. −1) × 14 hex

Unit address	Name	Enable timing
d+1, d+2	Operation mode selection	After completion of data writing

Data configuration	15 12 11 08 07 04 03 00	Data setting range	Default
d+1		Origin search operation: 0 to 3 Origin detection method: 0 to 2 Origin search direction: 0, 1 Origin search preset : 0, 1	0000
d+2		Encoder type: 0, 1	0000

Data Details

Use there parameters to make the operation mode settings (origin search operation mode) for each axis of the PCU. The bits specified as “0/00 (fixed)” are reserved by the system in the PCU and must always be set to 0. For details on settings, refer to *8-2-3 Data Settings Required for Origin Search*, and *8-6-3 PCU Data Settings for Using Absolute Encoders*.

Origin Search Operation

Select the origin search operation pattern. For details on operation patterns, refer to *8-2-4 Origin Search Operation*.

0: Reversal mode 1
1: Reversal mode 2
2: Single-direction mode
3: Reversal mode 3 (unit version 2.0 or later)

Origin Detection Method (Unit Version 2.0 or Later)

Select the origin detection method. For details on operation patterns, refer to *8-2-4 Origin Search Operation*.

0: With origin proximity input signal reversal
1: Without origin proximity input signal reversal
2: Not use origin proximity input signal

Origin Search Direction

This parameter sets the origin search direction to match the Zero Point Return Direction setting (Pn816) in the Servo Parameters. This parameter and Servo Parameter Pn816 must be set to the same value. For details on origin search operations, refer to *8-2-4 Origin Search Operation*.

0: Forward direction
1: Reverse direction

Origin Search Preset (Unit Version 2.0 or Later)

The present position can be automatically set to a preset value when the origin search has been completed normally. Refer to *8-2-6 Origin Search Preset* for details on the origin search preset.

0: Present position not set to preset value at completion of origin search
1: Present position set to preset value at completion of origin search

Encoder Type

Use this parameter to select incremental encoder or absolute encoder as the encoder for the Servomotor. Set the encoder type according to the functions of the Servomotor and Servo Drive being used, as follows.

0: Incremental encoder
1: Absolute encoder

Setting Example

In this example, an incremental encoder is used with axis 5, and origin search is set to reverse direction in single-direction mode.

18B1 hex: 1020 hex
18B2 hex: 0000 hex

Details

- *8-2-3 Data Settings Required for Origin Search*
- *8-2-4 Origin Search Operation*
- *8-2-6 Origin Search Preset*.
- *8-6-3 PCU Data Settings for Using Absolute Encoders*

4-5 Servo Parameter Area

4-5-1 G-series Servo Drive (R88D-GN□-ML2 with Built-in MECHATROLINK-II Communications)

The Servo Parameters listed here can be used when the Position Control Unit is used with a G-series Servo Drive (R88D-GN□-ML2) with built-in MECHATROLINK-II communications.

For further details on each of the parameters, refer to the user's manual for G-series Servo Drives.

The timing for Servo Parameters to be enabled are classified into the following two types.

Online (online parameters): Changed settings are enabled immediately after Servo Parameters have been written.

Offline (offline parameters): Changed settings are enabled when the Servo Drive power is cycled or DEVICE SETUP is executed.

The *Details* column indicates whether the following conditions apply to the corresponding parameter.

- Online parameters that can be changed when the axis is stopped (Busy Flag = 0) only.
- Parameters with standard set values when using MECHATROLINK are indicated in the *Details* column as “standard” with the set value.
  The standard settings are basic settings required when using the PCU. This manual describes operations assuming standard settings are being used.

For details on fixed and standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

Note Parameters marked with "(RT)" are automatically set during realtime autotuning. To set these parameters manually, disable realtime autotuning by setting the Realtime Autotuning Mode Selection (Pn021) to 0 before changing the parameter.

Note Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the *Servo Drive's operation manual* and always check the effect of changing the settings before changing the Servo Parameters.

Parameter Tables

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn000	Reserved	---	Do not change.		1	---	---	---	
Pn001	Default Display	2	Selects the data to be displayed on the 7-segment LED display on the front panel.		0	---	0 to 4	Online	
			0	Normal status ("--" Servo OFF, "00" Servo ON)					
			1	Indicates the machine angle from 0 to FF hex. 0 is the zero position of the encoder. The angle increases when the Servomotor turns forward. The count continues from "0" after exceeding "FF". When using an incremental encoder, the display shows "nF" (not Fixed) until detecting the zero position on the encoder after the control power is turned ON.					
			2	Indicates the electrical angle from 0 to FF hex. 0 is the position where the inductive voltage on the U phase reaches the position peak. The angle increases when the Servomotor turns forward. The count continues from "0" after exceeding "FF".					
			3	Indicates the number (total) of MECHATROLINKII communications errors from 0 to FF hex. The communications error count (total) saturates at the maximum of FFFFh. "h" appears only for the lowest byte. The count continues from "00" after exceeding "FF". **Note** The communications error count (total) is cleared by turning OFF the control power.					
			4	Indicates the setting on the rotary switch (node address value) loaded at startup, in decimal. This value does not change even if the rotary switch is turned after startup.					
			5 to 32767	Reserved (Do not set.)					
Pn002	Reserved	---	Do not change.		0	---	---	---	
Pn003	Torque Limit Selection	2	Selects the torque limit function, or the torque feed-forward function during speed control.		1	---	---	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			• Torque Limit Selection For torque control, always select Pn05E. For position control and speed control, select the torque limit as follows.		1	---	1 to 5		
			1	Use Pn05E as the limit value for forward and reverse operations.					
			2	Forward: Use Pn05E. Reverse: Use Pn05F.					
			3	Switch limits by torque limit values and input signals from the network. Limit in forward direction: PCL is OFF = Pn05E, PCL is ON = Pn05F Limit in reverse direction: NCL is OFF = Pn05E, NCL is ON = Pn05F					
			4	Forward: Use Pn05E as limit. Reverse: Use Pn05F as limit. Only in speed control, torque limits can be switched by torque limit values from the network as follows: Limit in forward direction: Use Pn05E command or option command value 1, whichever is smaller. Limit in reverse direction: Use Pn05F command or option command value 2, whichever is smaller.					
			5	Forward: Use Pn05E as limit. Reverse: Use Pn05F as limit. Only in speed control, torque limits can be switched by torque limit values and input signals from the network as follows: Limit in forward direction: PCL is OFF = Pn05E, PCL is ON = Pn05E command or option command value 1, whichever is smaller. Limit in reverse direction: NCL is OFF = Pn05F, NCL is ON = Pn05F command or option command value 2, whichever is smaller.					

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn003</td><td>Torque Limit Selection</td><td>2</td><td colspan="2">Note PCL ON: When either Forward Torque Limit (CN1 PCL: pin 7) or MECHATROLINKII Communications Option Field (P-CL) is ON.
PCL OFF: When both Forward Torque Limit (CN1 PCL: pin 7) and MECHATROLINK-II Communications Option Field (P-CL) are OFF.</td><td>1</td><td>---</td><td>1 to 5</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">• Torque Feed-forward Function Selection</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>1 to 3</td><td>Enabled only during speed control. Disabled if not using speed control.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>4 to 5</td><td>Always disabled</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn004</td><td>Drive Prohibit Input Selection</td><td>2</td><td colspan="2">Sets the function for the Forward and Reverse Drive Prohibit Inputs (CN1 POT: pin 19, NOT: pin 20)</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td></td><td></td><td></td><td>0</td><td>Decelerates and stops according to the sequence set in the Stop Selection for Drive Prohibition Input (Pn066) when both POT and NOT inputs are enabled.
When both POT and NOT inputs are OPEN, the Drive Prohibit Input Error (alarm code 38) will occur.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>1</td><td>Both POT and NOT inputs disabled.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>2</td><td>When either POT or NOT input becomes OPEN, the Drive Prohibit Input Error (alarm code 38) will occur.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn005</td><td>Communications Control</td><td>2</td><td colspan="2">Controls errors and warnings for MECHATROLINK-II communications.
Note Use with thi]s parameter set to 0. Program to stop immediately if using a value other than 0.
Set the Consecutive Communications Error Detection Count in COM_ERR (bit 8 to 11). The communications error (alarm code 83) will occur when a communications error, which is assessed at every MECHATROLINK-II communications cycle, occurs consecutively for the number of the Consecutive Communications Error Detection Count. The error and warning can be masked for debug purposes.
<table><tr><th>bits 15-12</th><th>bits 11-8</th><th>bits 7-4</th><th>bits 3-0</th></tr><tr><td>---</td><td>COM_ERR</td><td>MSK COM WARNG</td><td>MSK COM ALM</td></tr></table>• [bits 8-11] COM_ERR (Consecutive Communications Error Detection Count)
Setting range: 0 to 15.
Consecutive Communications Error Detection Count = COM_ERR + 2
Note These bits are debug functions. Set to enable (0) when not debugging.
• [bits 0-3] MECHATROLINK-II Communications Alarms Mask (MSK COM ALM)
[bit0]0: Communications error (alarm code 83) enabled
1: Communications error (alarm code 83) disabled
[bit1]0: Watchdog data error (alarm code 86) enabled
1: Watchdog data error (alarm code 86) disabled
• [bits 4-7] MECHATROLINK-II Communications Warnings Mask (MSK COM WARNG)
[bit4]0: Data setting warning (warning code 94h) enabled
1: Data setting warning (warning code 94h) disabled
[bit5]0: Command warning (warning code 95h) enabled
1: Command warning (warning code 95h) disabled
[bit6]0: ML-II communications warning (warning code 96h) enabled
1: ML-II communications warning (warning code 96h) disabled</td><td>0</td><td>---</td><td>0 to 3955</td><td>Offline</td><td>Always set to 0.</td></tr>
<tr><td>Pn006</td><td>Power ON Address Display Duration Setting</td><td>2</td><td colspan="2">Sets the duration to display the node address when the control power is turned ON.
Note The node address display has priority even if there are alarms or warnings at power ON.</td><td>30</td><td>ms</td><td>0 to 1000</td><td>Offline</td><td></td></tr>
<tr><td></td><td></td><td></td><td>0 to 6</td><td>600 ms</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>7 to 1000</td><td>set value × 100 ms</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn007	Speed monitor (SP) Selection	2	Selects the output to the Analog Speed Monitor (SP on the front panel). **Note** This monitor output has a delay due to filtering. The Operating Direction Setting (Pn043) does not affect this monitor output. Thus, forward rotation is always positive (+), and reverse rotation is always negative (–).		3	---	0 to 11	Online	
			0	Actual Servomotor speed: 47 r/min/6 V					
			1	Actual Servomotor speed: 188 r/min/6 V					
			2	Actual Servomotor speed: 750 r/min/6 V					
			3	Actual Servomotor speed: 3000 r/min/6 V					
			4	Actual Servomotor speed: 12000 r/min/6 V					
			5	Command speed: 47 r/min/6 V					
			6	Command speed: 188 r/min/6 V					
			7	Command speed: 750 r/min/6 V					
			8	Command speed: 3000 r/min/6 V					
			9	Command speed: 12000 r/min/6 V					
			10	Outputs the Issuance Completion Status (DEN). 0 V: Issuing 5 V: Issuance complete					
			11	Outputs the Gain Selection Status. 0 V: Gain 2 5 V: Gain 1					
Pn008	Torque Monitor (IM) Selection	2	Selects the output to the Analog Torque Monitor (IM on the front panel) **Note** This monitor output has a delay due to filtering. The Operating Direction Setting (Pn043) does not affect this monitor output. Thus, forward rotation is always positive (+), and reverse rotation is always negative (–).		0	---	0 to 14	Online	
			0	Torque command: 100%/3 V					
			1	Position deviation: 31 pulses/3 V					
			2	Position deviation: 125 pulses/3 V					
			3	Position deviation: 500 pulses/3 V					
			4	Position deviation: 2000 pulses/3 V					
			5	Position deviation: 8000 pulses/3 V					
			6 to 10	Reserved					
			11	Torque command: 200%/3 V					
			12	Torque command: 400%/3 V					
			13	Outputs the Issuance Completion Status (DEN). 0 V: Issuing 5 V: Issuance complete					
			14	Outputs the Gain Selection Status. 0 V: Gain 2 5 V: Gain 1					
Pn009	Reserved	---	Do not change.		0	---	---	---	
Pn00A	Prohibit Parameter Changes via Network	2	Allows/prohibits parameter changes via the network.		0	---	0, 1	Online	
			0	Allows parameter changes from the host controller via the network.					
			1	Prohibits parameter changes from the host controller via the network. Attempting to change a parameter via the network when prohibited triggers the Command Warning (warning code 95h).					
Pn00B	Operation Switch When Using Absolute Encoder	2	Selects how the an absolute encoder is used. This parameter is disabled when using an incremental encoder.		0	---	0 to 2	Online	
			0	Use as an absolute encoder.					
			1	Use an absolute encoder as an incremental encoder.					
			2	Use as an absolute encoder but ignore absolute multiturn counter overflow alarm (alarm code 41).					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn00C	RS-232 Baud Rate Setting	2	Sets the baud rate for RS-232 communications.		2	---	0 to 5	Online	
			0	2,400 bps					
			1	4,800 bps					
			2	9,600 bps					
			3	19,200 bps					
			4	38,400 bps					
			5	57,600 bps					
Pn00D	Reserved	---	Do not change.		0	---	---	---	
Pn00E	Reserved	---	Do not change.		0	---	---	---	
Pn00F	Reserved	---	Do not change.		0	---	---	---	
Pn010	Position Loop Gain (RT)	2	Sets the position loop responsiveness. Increasing the gain increases position control responsiveness and shortens stabilization time. Oscillation or overshoot will occur if set too high. Adjust for optimum responsiveness.		400	×0.1 [1/s]	0 to 30000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn011	Speed Loop Gain (RT)	2	Sets the speed loop responsiveness. If the Inertia Ratio (Pn020) is set correctly, this parameter is set to the Servomotor response frequency. Increasing the gain increases the speed control responsiveness, but too much gain may cause oscillating. Small gain may cause overshoot in the speed response. Adjust for optimum responsiveness.		500	×0.1 Hz	1 to 30000	Online	
Pn012	Speed Loop Integration Time Constant (RT)	2	Adjusts the speed loop integration time constant. Set a large value for large load inertia. Decrease the setting for fast response with small inertia. Set 9999 to stop integration operation while retaining the integration value. A setting of 10000 disables integration.		200	×0.1 ms	1 to 10000	Online	
Pn013	Speed Feedback Filter Time Constant (RT)	2	Sets the type of speed detection filter time constant. Normally, use a setting of 0. Increasing the value reduces the noise of the Servomotor but also reduces its responsiveness. This parameter is disabled if the Instantaneous Speed Observer Setting (Pn027) is enabled.		0	---	0 to 5	Online	
Pn014	Torque Command Filter Time Constant (RT)	2	Adjusts the first-order lag filter time constant for the torque command section. The torque filter setting may reduce machine vibration.		80	×0.01 ms	0 to 2500	Online	
Pn015	Speed Feedforward Amount (RT)	2	Sets the speed feed-forward amount. This parameter is particularly useful when fast response is required.		300	×0.1 %	0 to 1000	Online	
Pn016	Feed-forward Filter Time Constant (RT)	2	Sets the time constant for the speed feed-forward first-order lag filter.		100	×0.01 ms	0 to 6400	Online	
Pn017	Reserved	---	Do not change.		0	---	---	---	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th colspan="2">Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn018</td><td>0 to 6400</td><td>2</td><td colspan="3">Sets the position loop gain when using gain 2 switching.
Same function as Pn010.</td><td>200</td><td>×0.1 [1/s]</td><td>0 to 30000</td><td>Online</td><td rowspan="6">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn019</td><td>Speed Loop Gain 2 (RT)</td><td>2</td><td colspan="3">Sets the speed loop gain when using gain 2 switching.
Same function as Pn011.</td><td>800</td><td>×0.1 Hz</td><td>1 to 30000</td><td>Online</td></tr>
<tr><td>Pn01A</td><td>Speed Loop Integration Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the speed loop integration time constant when using gain 2 switching.
Same function as Pn012.
Set 9999 to stop integration operation while retaining the integration value. Setting 10000 disables integration.</td><td>500</td><td>×0.1 ms</td><td>1 to 10000</td><td>Online</td></tr>
<tr><td>Pn01B</td><td>Speed Feedback Filter Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the speed detection filter when using gain 2 switching.
Same function as Pn013. Normally, use a setting of 0.
When Instantaneous Speed Observer Setting (Pn027) is enabled, this parameter will be disabled.</td><td>0</td><td>---</td><td>0 to 5</td><td>Online</td></tr>
<tr><td>Pn01C</td><td>Torque Command Filter Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the first-order lag filter time constant for the torque command section when using gain 2 switching.
Same function as Pn014.</td><td>100</td><td>×0.01 ms</td><td>0 to 2500</td><td>Online</td></tr>
<tr><td>Pn01D</td><td>Notch Filter 1 Frequency</td><td>2</td><td colspan="3">Sets the notch frequency of notch filter 1 for resonance suppression.
This filter must be matched with the resonance frequency of the load.
100 to 1499: Filter enabled
1500: Filter disabled</td><td>1500</td><td>Hz</td><td>100 to 1500</td><td>Online</td></tr>
<tr><td>Pn01E</td><td>Notch Filter 1 Width</td><td>2</td><td colspan="3">Selects the notch width of notch filter 1 for resonance suppression.
Normally, use a setting of 2.</td><td>2</td><td>---</td><td>2</td><td>Online</td></tr>
<tr><td>Pn01F</td><td>Reserved</td><td>---</td><td colspan="3">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn020</td><td>Inertia Ratio (RT)</td><td>2</td><td colspan="3">Sets the load inertia as a percentage of the Servomotor rotor inertia.
Setting [%] = (Load inertia / Rotor inertia) × 100
The inertia ratio estimated during realtime autotuning is stored in the EEPROM every 30 minutes.</td><td>300</td><td>%</td><td>0 to 10000</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn021</td><td>Realtime Autotuning Mode Selection</td><td>2</td><td colspan="3">Sets the operating mode for realtime autotuning.
A setting of 3 or 6 will provide faster response to changes in inertia during operation. Operation, however, may be unstable depending on the operating pattern.
Normally, use a setting of 1 or 4.
Set to 4 to 6 when the Servomotor is used as a vertical axis.
Gain switching is enabled at set values 1 to 6.
Use a setting of 7 if operation changes caused by gain switching are a problem.
0: Disabled (---)
1: Horizontal axis mode (Almost no change)
2: Horizontal axis mode (Gradual changes)
3: Horizontal axis mode (Sudden changes)
4: Vertical axis mode (Almost no change)
5: Vertical axis mode (Gradual changes)
6: Vertical axis mode (Sudden changes)
7: Gain switching disable mode (Almost no change)</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td></tr>
<tr><td>Pn022</td><td>Realtime Autotuning Machine Rigidity Selection</td><td>2</td><td colspan="3">Sets the machine rigidity for realtime autotuning.
Increasing this value increases the responsiveness.
If the value is changed suddenly by a large amount, the gain will change rapidly, subjecting the machine to shock.
Always start by making small changes in the value, and gradually increase the value while monitoring machine operation.
Cannot be set to 0 when using the Parameter Unit.</td><td>2</td><td>---</td><td>0 to F</td><td>Online</td></tr>
</table>

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn023</td><td>Adaptive Filter Selection</td><td>2</td><td colspan="2">Enables or disables the adaptive filter.
The Adaptive Filter Table Number Display (Pn02F) will be reset to 0 when disabled.
Note When the Vibration Filter Selection (Pn024) is set to a low-pass filter type (Pn024 = 3 to 5), the adaptive filter is forcibly set to disabled (Pn023 = 0).
0 — Adaptive filter disabled.
1 — Adaptive filter enabled. Adaptive operation performed.
2 — Adaptive filter enabled. Adaptive operation will not be performed (i.e., retained).</td><td>0</td><td>---</td><td>0 to 2</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn024</td><td>Vibration Filter Selection</td><td>2</td><td colspan="2">Selects the vibration filter type and switching mode.
• Filter type selection
• Normal type:
Vibration frequency setting range 10.0 to 200.0 Hz
• Low-pass type:
Vibration frequency setting range 1.0 to 200.0 Hz
• Switching mode selection
• No switching: Both 1 and 2 are enabled
• Switching with command direction:
Selects Vibration Frequency 1 in forward direction (Pn02B, Pn02C)
Selects Vibration Frequency 2 in reverse direction (Pn02D, Pn02E)
<table>
<tr><th></th><th>Filter type</th><th>Switching mode</th></tr>
<tr><td>0</td><td>Normal type</td><td>No switching</td></tr>
<tr><td>1</td><td></td><td></td></tr>
<tr><td>2</td><td></td><td>Switching with command direction</td></tr>
<tr><td>3</td><td>Low-pass type</td><td>No switching</td></tr>
<tr><td>4</td><td></td><td></td></tr>
<tr><td>5</td><td></td><td>Switching with command direction</td></tr>
</table></td><td>0</td><td>---</td><td>0 to 5</td><td>Offline</td><td></td></tr>
<tr><td>Pn025</td><td>Normal Mode Autotuning Operation Setting</td><td>2</td><td colspan="2">Sets the operating pattern for normal mode autotuning.
<table>
<tr><th></th><th>Number of rotations</th><th>Rotation direction</th></tr>
<tr><td>0</td><td>Repeat cycles of 2 rotations</td><td>Forward and Reverse (Alternating)</td></tr>
<tr><td>1</td><td></td><td>Reverse and Forward (Alternating)</td></tr>
<tr><td>2</td><td></td><td>Forward only</td></tr>
<tr><td>3</td><td></td><td>Reverse only</td></tr>
<tr><td>4</td><td>Repeat cycles of single rotation</td><td>Forward and Reverse (Alternating)</td></tr>
<tr><td>5</td><td></td><td>Reverse and Forward (Alternating)</td></tr>
<tr><td>6</td><td></td><td>Forward only</td></tr>
<tr><td>7</td><td></td><td>Reverse only</td></tr>
</table></td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn026</td><td>Overrun Limit Setting</td><td>2</td><td colspan="2">Sets the Servomotor's allowable operating range for the position command input range.
Set to 0 to disable the overrun protective function.</td><td>10</td><td>×0.1 rotation</td><td>0 to 1000</td><td>Online</td><td></td></tr>
<tr><td>Pn027</td><td>Instantaneous Speed Observer Setting (RT)</td><td>2</td><td colspan="2">The Instantaneous Speed Observer improves speed detection accuracy, thereby improving responsiveness and reducing vibration when stopping.
When the instantaneous speed observer is enabled, both Speed Feedback Filter Time Constant (Pn013) and Speed Feedback Filter Time Constant 2 (Pn01B) are disabled.
This feature cannot be used with realtime autotuning.
0 — Disabled
1 — Enabled</td><td>0</td><td>---</td><td>0, 1</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn028</td><td>Notch Filter 2 Frequency</td><td>2</td><td colspan="2">Sets the notch frequency of notch filter 2 for resonance suppression.
This parameter must be matched with the resonance frequency of the load.
100 to 1499 — Filter enabled
1500 — Filter disabled</td><td>1500</td><td>Hz</td><td>100 to 1500</td><td>Online</td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn029	Notch Filter 2 Width	2	Selects the notch width of notch filter 2 for resonance suppression. Increasing the value increases the notch width.		2	---	0 to 4	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn02A	Notch Filter 2 Depth	2	Selects the notch depth of notch filter 2 for resonance suppression. Increasing this value decreases the notch depth, thereby reducing the phase lag.		0	---	0 to 99	Online	
Pn02B	Vibration Frequency 1	2	Sets the vibration frequency 1 for damping control to suppress vibration at the end of the load. Measure and set the frequency of the vibration. The frequency setting range depends on the filter type selected in the Vibration Filter Selection (Pn024). • Normal type Setting frequency range: 10.0 to 200.0 Hz (Disabled when set to 0 to 99) • Low-pass type Setting frequency range: 1.0 to 200.0 Hz (Disabled when set to 0 to 9)		0	×0.1 Hz	0 to 2000	Online	
Pn02C	Vibration Filter 1 Setting	2	When setting Vibration Frequency 1 (Pn02B), reduce this setting if torque saturation occurs, or increase it to make the movement faster. Normally, use a setting of 0. The setting range depends on the filter type selected in the Vibration Filter Selection (Pn024), and if Vibration Filter 1 is enabled, the ranges are as follows: **Note** This parameter is disabled when Vibration Filter 1 is disabled. • Normal type Setting range: 100 ≤ Pn02B + Pn02C ≤ Pn02B × 2 or 2000 • Low-pass type Setting range: 10 ≤ Pn02B + Pn02C ≤ Pn02B × 6		0	×0.1 Hz	–200 to 2000	Online	
Pn02D	Vibration Frequency 2	2	Same function as Pn02B.		0	×0.1 Hz	0 to 2000	Online	
Pn02E	Vibration Filter 2 Setting	2	Same function as Pn02C.		0	×0.1 Hz	–200 to 2000	Online	
Pn02F	Adaptive Filter Table Number Display	2	Displays the table entry number corresponding to the frequency of the adaptive filter. This parameter is set automatically when the adaptive filter is enabled (i.e., when the Adaptive Filter Selection (Pn023) is set to a value other than 0), and cannot be changed. When the adaptive filter is enabled, this parameter will be saved in EEPROM approximately every 30 min. If the adaptive filter is enabled the next time the power supply is turned ON, adaptive operation will start with the data saved in EEPROM as the default value. To clear this parameter and reset the adaptive operation, disable the adaptive filter by setting the Adaptive Filter Selection (Pn023) to 0, and then enable it again.		0	---	0 to 64	Online	This is a read-only parameter. You cannot change the setting.
			0 to 4	Filter disabled					
			5 to 48	Filter enabled					
			49 to 64	Enable or disable the filter with Pn022					
Pn030	Gain Switching Operating Mode Selection (RT)	2	Enables or disables gain switching.		1	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Disabled. Uses Gain 1 (Pn010 to Pn014). PI/P operation is switched from MECHATROLINK-II.					
			1	The gain is switched between Gain 1 (Pn010 to Pn014) and Gain 2 (Pn018 to Pn01C).					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn031	Gain Switch Setting (RT)	2	Sets the trigger for gain switching. The details depend on the control mode.		2	---	0 to 10	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Always Gain 1					
			1	Always Gain 2					
			2	Switching from the network					
			3	Amount of change in torque command					
			4	Always Gain 1					
			5	Speed command					
			6	Amount of position deviation					
			7	Position command pulses received					
			8	Positioning Completed Signal (INP) OFF					
			9	Actual Servomotor speed					
			10	Combination of position command pulses received and speed					
Pn032	Gain Switch Time (RT)	2	Enabled when the Gain Switch Setting (Pn031) is set to 3, or 5 to 10. Sets the lag time from the trigger detection to actual gain switching when switching from gain 2 to gain 1.		30	×166 μs	0 to 10000	Online	
Pn033	Gain Switch Level Setting (RT)	2	Sets the judgment level to switch between Gain 1 and Gain 2 when the Gain Switch Setting (Pn031) is set to 3, 5, 6, 9, or 10. The unit for the setting depends on the condition set in the Gain Switch Setting (Pn031).		600	--	0 to 20000	Online	
Pn034	Gain Switch Hysteresis Setting (RT)	2	Sets the hysteresis of the judgment level for the Gain Switch Level Setting (Pn033) when the Gain Switch Setting (Pn031) is set to 3, 5, 6, 9, or 10. The unit for the setting depends on the condition set in the Gain Switch Setting (Pn031).		50	---	0 to 20000	Online	
Pn035	Position Loop Gain Switching Time (RT)	2	This parameter can prevent the position loop gain from increasing suddenly when the position loop gain and position loop gain 2 differ by a large amount. When the position loop gain increases, it takes the duration of (set value + 1) × 166 μs.		20	×166 μs	0 to 10000	Online	
Pn036	Reserved	---	Do not change.		0	---	---	---	
Pn037	Reserved	---	Do not change.		0	---	---	---	
Pn038	Reserved	---	Do not change.		0	---	---	---	
Pn039	Reserved	---	Do not change.		0	---	---	---	
Pn03A	Reserved	---	Do not change.		0	---	---	---	
Pn03B	Reserved	---	Do not change.		0	---	---	---	
Pn03C	Reserved	---	Do not change.		0	---	---	---	
Pn03D	Jog Speed	2	Sets the jog operation speed with the Parameter Unit or CX-Drive. **Note** Jog operation is only available when the network is not established. Do not try to establish the network while using jog operation. Otherwise, command alarm (alarm code 27) will occur.		200	r/min	0 to 500	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn03E	Reserved	---	Do not change.		0	---	---	---	
Pn03F	Reserved	---	Do not change.		0	---	---	---	
Pn040	Reserved	---	Do not change.		0	---	---	---	
Pn041	Emergency Stop Input Setting	2	Enables the Emergency Stop Input (STOP). **Note** If this function is disabled, the response status will always be 0 (disabled).		1	---	0, 1	Offline	
			0	Disabled.					
			1	Enabled (alarm code 87 issued on OPEN)					
Pn042	Origin Proximity Input Logic Setting	2	Sets the logic for the Origin Proximity Input (DEC).		1	---	0, 1	Offline	
			0	N.C contact (origin proximity detected on OPEN)					
			1	N.O contact (origin proximity detected on CLOSE)					
Pn043	Operating Direction Setting	2	Sets the relationship between polarity of operation data sent over the network and the direction of Servomotor rotation. **Note** In RS-232C communications and on the analog monitor (SP, IM) on the front panel, forward direction is always positive (+), and reverse rotation is always negative (–).		1	---	0, 1	Offline	
			0	Disabled.					
			1	Enabled (alarm code 87 issued on OPEN)					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn044	Input Signal Selection	2	Sets the terminal assignment for Drive Prohibit Input.		1	---	0, 1	Offline	
			0	Sets CN1 pin 19 to POT, CN1 pin 20 to NOT.					
			1	Sets CN1 pin 19 to NOT, CN1 pin 20 to POT.					
Pn045	Reserved	---	Do not change.		0	---	---	---	
Pn046	Reserved	---	Do not change.		0	---	---	---	
Pn047	Reserved	---	Do not change.		0	---	---	---	
Pn048	Reserved	---	Do not change.		0	---	---	---	
Pn049	Reserved	---	Do not change.		0	---	---	---	
Pn04A	Reserved	---	Do not change.		0	---	---	---	
Pn04B	Reserved	---	Do not change.		0	---	---	---	
Pn04C	Reserved	---	Do not change.		0	---	---	---	
Pn04D	Reserved	---	Do not change.		0	---	---	---	
Pn04E	Reserved	---	Do not change.		0	---	---	---	
Pn04F	Reserved	---	Do not change.		0	---	---	---	
Pn050	Reserved	---	Do not change.		0	---	---	---	
Pn051	Reserved	---	Do not change.		0	---	---	---	
Pn052	Reserved	---	Do not change.		0	---	---	---	
Pn053	Speed Limit	2	Sets the speed limit for torque control mode. (The value is an absolute value) This parameter is limited by the Overspeed Detection Level Setting (Pn073).		50	r/min	–20000 to 20000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn054	Reserved	---	Do not change.		0	---	---	---	
Pn055	Reserved	---	Do not change.		0	---	---	---	
Pn056	Reserved	---	Do not change.		0	---	---	---	
Pn057	Reserved	---	Do not change.		0	---	---	---	
Pn058	Soft Start Acceleration Time	2	Sets the acceleration time for speed control mode. Acceleration time [s] from 0 r/min to maximum speed [r/min] = Set value × 2 ms		0	×2 ms	0 to 5000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn059	Soft Start Deceleration Time	2	Sets the deceleration time for speed control mode. Deceleration time [s] from maximum speed [r/min] to 0 r/min = Set value × 2 ms		0	×2 ms	0 to 5000	Online	
Pn05A	Reserved	---	Do not change.		0	---	---	---	
Pn05B		2	Selects the speed limit for torque control mode.		0	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Use the Speed Limit (Pn053)					
			1	Use the speed limit value via MECHATROLINK-II or the Speed Limit (Pn053), whichever is smaller.					
Pn05C	Reserved	---	Do not change.		0	---	---	---	
Pn05D	Reserved	---	Do not change.		0	---	---	---	
Pn05E	No. 1 Torque Limit	2	Sets the No. 1 Torque Limit for the Servomotor output torque. Refer to information on the Torque Limit Selection (Pn003) to select the torque limit. The maximum value of the setting range depends on the applicable Servomotor.		300	%	0 to 500	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn05F	No. 2 Torque Limit	2	Sets the No. 2 torque limit for the Servomotor output torque. Refer to information on the Torque Limit Selection (Pn003) to select the torque limit. The maximum value of the setting range depends on the applicable Servomotor.		100	%	0 to 500	Online	
Pn060	Positioning Completion Range 1	2	Sets the positioning completion range when Positioning Completion 1 (INP1) Output is selected. Positioning is complete when all positioning command pulses are exhausted, and the absolute value of the position deviation converted into command units is less than this setting.		25	Command units	0 to 10000	Online	

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn061	Speed Conformity Signal Output Width	2	Sets the detection width for the speed conformity detection (VCMP) signal. Speed conformity is achieved when the absolute value of the difference between the internal speed command (before acceleration and deceleration limits are applied) and the Servomotor speed is less than the set speed. **Note** This setting has a hysteresis of 10 r/min.		20	r/min	10 to 20000	Online	
Pn062	Rotation Speed for Motor Rotation Detection	2	Sets the threshold level for the speed reached (TGON) signal. Speed reached is determined when the absolute value of the Servomotor speed is greater than the setting speed. **Note** Speed reached detection has a hysteresis of 10 r/min.		50	r/min	10 to 20000	Online	
Pn063	Positioning Completion Range 2	2	Sets the positioning completion range when Positioning Completion 2 (INP2) is selected. Positioning is complete when the absolute value of the position deviation converted into command units is less than this setting, regardless of whether position command pulses are still being processed.		100	Command units	0 to 10000	Online	
Pn064	Motor Phase Current Offset Re-adjustment Setting	2	Enables or disables the offset component readjustment function of the Motor Phase Current Detector (CT) for Servo ON command inputs. The readjustment is made when control power is turned ON. **Note** This adjustment is inaccurate if the offset is measured while the Servomotor is rotating. To enable this function, do not rotate the Servomotor when inputting the Servo ON command.		0	---	0, 1	Online	
			0	Disabled (only when turning ON control power)					
			1	Enabled (when turning ON control power, or at Servo ON)					
Pn065	Undervoltage Alarm Selection	2	Selects whether to activate the main power supply undervoltage function (alarm code 13) when the main power supply is interrupted for the duration of the Momentary Hold Time (Pn06D) during Servo ON.		1	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Turns the Servo OFF according to the setting for the Stop Selection with Main Power OFF (Pn067), interrupting the positioning command generation process (positioning operation) within the Servo Drive. When the main power supply is turned back ON, Servo ON will resume. Restart the positioning operation after performing the positioning operation and recovering from Servo OFF.					
			1	Causes an error due to main power supply undervoltage (alarm code 13). This parameter is disabled if Pn06D = 1,000. If Pn06D is set too long and the voltage between P and N in the main power supply converter drops below the specified value before a main power supply interruption is detected, a main power supply undervoltage (alarm code 13) will occur.					

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn066</td><td>Stop Selection for Drive Prohibition Input</td><td>2</td><td colspan="2">Sets the deceleration stop operation to be performed after the Forward Drive Prohibit Input (POT) or Reverse Drive Prohibit Input (NOT) is enabled.

<table>
<tr><th></th><th>During deceleration</th><th>After stopping (30 r/min or less)</th><th>Deviation counter</th></tr>
<tr><td>0</td><td>Dynamic brake</td><td>Disables torque command in drive prohibited direction</td><td>Cleared while decelerating with dynamic brake. Retained after stopping.</td></tr>
<tr><td>1</td><td>Disables torque</td><td>Disables torque command in drive prohibited direction</td><td>Cleared while decelerating. Retained after stopping.</td></tr>
<tr><td>2</td><td>Emergency Stop Torque (Pn06E)</td><td>Servo locked</td><td>Retained while decelerating, cleared upon completion of deceleration, and retained after stopping.</td></tr>
</table>

Note 1. The positioning command generation process (positioning operation) within the Servo Drive will be forcibly stopped once it enters the deceleration mode. Also, when the deceleration mode is activated during speed control or torque control, it will switch to position control. If a positioning operation command is received during deceleration, the internal positioning command generation process will be retained, and after deceleration is complete, positioning operation will be activated.
Note 2. When the Servomotor rotation speed is 30 r/min or less (stopped), the deceleration mode will not be activated even if the drive prohibit input is enabled.
Note 3. When the parameter is set to 2 and an operation command in the drive prohibited direction is received after stopping, a command warning (warning code 95h) will be issued. When the parameter is set to 0 or 1, the operation command in the prohibited direction after stopping will be accepted, but the Servomotor will not operate and the position deviation will accumulate because the torque command is 0. Take measures such as issuing a command in the reverse direction from the host controller.
Note 4. When the parameter is set to 2, MECHATROLINK-II communications are interrupted, and either Forward or Reverse Drive Prohibit Input (POT or NOT) is turned ON, receiving an operation command (jog operation or normal mode autotuning) via RS232 will cause a Drive Prohibit Input Error (alarm code 38). A Drive Prohibit Input Error (alarm code 38) will also occur if either POT or NOT is turned ON while operating on an operation command received via RS232.</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td>P067</td><td>Stop Selection with Main Power OFF</td><td>2</td><td colspan="2">Sets the operation to be performed during deceleration and after stopping after the main power supply is turned OFF with the Undervoltage Alarm Selection (Pn065) set to 0. The deviation counter will be reset when the power OFF is detected.
0 and 4: Use dynamic brake to decelerate and remain stopped with dynamic brake.
1 and 5: Use free-run to decelerate and remain stopped with dynamic brake.
2 and 6: Use dynamic brake to decelerate, but free the motor when stopped.
3 and 7: Use free-run to decelerate, and free the motor when stopped.</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn068</td><td>Stop Selection for Alarm Generation</td><td>2</td><td colspan="2">Sets the deceleration process and stop status after an alarm is issued by the protective function. The deviation counter will be reset when an alarm is issued.
0: Use dynamic brake to decelerate and remain stopped with dynamic brake.
1: Use free-run to decelerate and remain stopped with dynamic brake.
2: Use dynamic brake to decelerate, but free the motor when stopped.
3: Use free-run to decelerate, and free the motor when stopped.</td><td>0</td><td>---</td><td>0 to 3</td><td>Online</td><td></td></tr>
<tr><td>Pn069</td><td>Stop Selection with Servo OFF</td><td>2</td><td colspan="2">Sets the operational conditions to apply during deceleration and after stopping when the Servo is turned OFF.
The relationship between set values, operation, and deviation counter processing for this parameter is the same as for the Stop Selection with Main Power OFF (Pn067).</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td><td></td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn06A	Brake Timing When Stopped	2	Sets the duration from when the Brake Interlock (BKIR) signal turns OFF to when the Servomotor is de-energized when the RUN command is turned OFF with the Servomotor stopped. **Note** The brake interlock signal is the logical OR of the brake release request from the network and the release request from the Servo controller. Note, the brake release request from the network is OFF (operation request is ON) at power ON.		10	2 ms	0 to 1000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn06B	Brake Timing during Operation	2	When the run command (RUN) is turned OFF during the Servomotor rotation, the Servomotor will decelerate reducing the rotation speed and the Brake Interlock Signal (BKIR) will turn OFF after the time set by this parameter has elapsed. BKIR turns OFF if the Servomotor speed drops below 30 r/min before the set time. **Note** The brake interlock signal is the logical OR of the brake release request from the network and the release request from the Servo controller. Note, the brake release request from the network is OFF (operation request is ON) at power ON.		50	2 ms	0 to 1000	Online	
Pn06C	Regeneration Resistor Selection	2	Sets the regeneration resistor operation and the regeneration overload (alarm code 18) operation. Set this parameter to 0 if using the built-in regeneration resistor. If using an external regeneration resistor, be sure to turn OFF the main power when the built-in thermal switch is activated.		0	---	0 to 3	Offline	
			0	Sets the regeneration overload to match the built-in regeneration resistor. (regeneration load ratio below 1%)					
			1	The regeneration overload (alarm code 18) occurs when the load ratio of the external regeneration resistor exceeds 10%.					
			2	The regeneration processing circuit by the external regeneration resistor is activated, but the regeneration overload (alarm code 18) does not occur.					
			3	The regeneration processing circuit is not activated. All regenerative energy is absorbed by the built-in capacitor.					
Pn06D	Momentary Hold Time	2	Sets the amount of time required to detect shutoff when the main power supply continues to shut off. The main power OFF detection will be disabled if this parameter is set to 1000.		35	2 ms	35 to 1000	Offline	
Pn06E	Emergency Stop Torque	2	Sets the torque limit during deceleration because of the Drive Prohibition Input when the Stop Selection for Drive Prohibition Input (Pn066) is set to 2. When this parameter is set to 0, the normal torque limit will be set. The maximum value of the setting range depends on the Servomotor.		0	%	0 to 300	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn06F	Reserved	---	Do not change.		0	---	---	---	
Pn070	Reserved	---	Do not change.		0	---	---	---	
Pn071	Reserved	---	Do not change.		0	---	---	---	
Pn072	Overload Detection Level Setting	2	Sets the overload detection level. The overload detection level will be set at 115% if this parameter is set to 0. Normally, use a setting of 0, and set the level only when reducing the overload detection level.		0	%	0 to 500	Online	
Pn073	Overspeed Detection Level Setting	2	Sets the overspeed detection level. The overspeed detection level is 1.2 times the maximum Servomotor rotation speed when the parameter is set to 0. Normally, use a setting of 0, and set the level only when reducing the overspeed detection level. **Note** The detection margin of error for the setting is ±3 r/min for a 7-core absolute encoder and ±36 r/min for a 5-core incremental encoder.		0	r/min	0 to 20000	Online	
Pn074	Reserved	---	Do not change.		0	---	---	---	
Pn075	Reserved	---	Do not change.		0	---	---	---	
Pn076	Reserved	---	Do not change.		0	---	---	---	
Pn077	Reserved	---	Do not change.		0	---	---	---	
Pn078	Reserved	---	Do not change.		0	---	---	---	
Pn079	Reserved	---	Do not change.		0	---	---	---	
Pn07A	Reserved	---	Do not change.		0	---	---	---	
Pn07B	Reserved	---	Do not change.		0	---	---	---	
Pn07C	Reserved	---	Do not change.		0	---	---	---	
Pn07D	Reserved	---	Do not change.		0	---	---	---	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn07E</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn07F</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn100</td><td>Backlash Compensation Selection</td><td>2</td><td colspan="2">Enables or disables the backlash compensation for position control, and sets the compensation direction.
0: Disabled
1: Compensates in the initial positive direction after the Servo ON.
2: Compensates in the initial negative direction after the Servo ON.</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td>Pn101</td><td>Backlash Compensation</td><td>2</td><td colspan="2">Sets the backlash compensation amount for position control.</td><td>0</td><td>Command units</td><td>–32768 to 32767</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn102</td><td>Backlash Compensation Time Constant</td><td>2</td><td colspan="2">Sets the backlash compensation time constant for position control.
<table><tr><th>Value of Pn100</th><th>Pn101 = Positive number</th><th>Pn101 = Negative number</th></tr><tr><td>1</td><td>Compensates in positive direction during rotation in positive direction</td><td>Compensates in negative direction during rotation in positive direction</td></tr><tr><td>2</td><td>Compensates in positive direction during rotation in negative direction</td><td>Compensates in negative direction during rotation in negative direction</td></tr></table></td><td>0</td><td>0.01 ms</td><td>0 to 6400</td><td>Online</td></tr>
<tr><td>Pn103</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn104</td><td>Soft Limit</td><td>2</td><td colspan="2">Enables or disables the soft limit.
When enabled, the soft limit values are set in Forward Software Limit (Pn201) and Reverse Software Limit (Pn202).
Note The response value for limit signals disabled by this setting will be set to 0. The response value for limit signals is also set to 0 when the Servomotor does not complete its return to origin.
0: Enable both the Forward / Reverse Software Limits (Pn201 and Pn202)
1: Disable the Forward Software Limit (Pn201), enable the Reverse Software Limit (Pn202)
2: Enable the Forward Software Limit (Pn201), disable the Reverse Software Limit (Pn202)
3: Disable both the Forward / Reverse Software Limits (Pn201 and Pn202)</td><td>0</td><td>---</td><td>0 to 3</td><td>Online</td><td></td></tr>
<tr><td>Pn105</td><td>Origin Range</td><td>2</td><td colspan="2">Sets the threshold for detecting the origin (ZPOINT) in absolute values.
ZPOINT = 1 when the return to origin completes (coordinate system setup is complete) and the feedback position is within the setting range of this parameter.</td><td>10</td><td>Command units</td><td>0 to 250</td><td>Online</td><td></td></tr>
<tr><td>Pn106</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn107</td><td>Linear Acceleration Constant</td><td>2</td><td colspan="2">Sets the acceleration for positioning operations.
A setting of "0" is regarded as "1".
The setting will be handled after conversion to an unsigned 16-bit data (0 to 65535).
Example: –32768 → 8000h = 32768
–1 → FFFFh = 65535</td><td>100</td><td>× 10000 [command units/s^2]</td><td>–32768 to 32767</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn108</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn109</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10A</td><td>Linear Deceleration Constant</td><td>2</td><td colspan="2">Sets the deceleration for positioning operations.
A setting of "0" is regarded as "1".
The setting will be handled after conversion to an unsigned 16-bit data (0 to 65535).
Example: –32768 → 8000h = 32768
–1 → FFFFh = 65535</td><td>100</td><td>× 10000 [command units/s^2]</td><td>–32768 to 32767</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn10B</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10C</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10D</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn10E	Moving Average Time	2	Sets the moving average time for position commands. **Note** If the Moving Average Time is set, commands may not be executed seamlessly when switching the control mode, and when switching between interpolation feed motions and positioning motions (motions wherein the command waveforms are generated inside the Servo Drive).		0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn10F	Origin Return Mode Settings	2	Sets the direction for origin return.		0	---	0, 1	Online	
			0	Positive direction					
			1	Negative direction					
Pn110	Origin Return Approach Speed 1	2	Sets the operating speed for origin return from when the origin proximity signal is turned ON, to when it is turned OFF and the latch signal is detected. This parameter can be set to a maximum value of 32767, but internally the speed is limited to the Servomotor's maximum speed.		50	100 [command units/s]	1 to 32767	Online	
Pn111	Origin Return Approach Speed 2	2	Sets the operating speed for origin return, from when the point after the latch signal is detected to when the Origin Return Final Distance (Pn204) is reached. This parameter can be set to a maximum value of 32767, but internally the speed is limited to the Servomotor's maximum speed.		5	100 [command units/s]	1 to 32767	Online	
Pn112	General-purpose Output 1 Function Selection	2	Selects the function for general-purpose output 1 (OUTM1).		7	---	0 to 9	Offline	Standard setting
			0	Always OFF					
			1	INP1 output. Turn ON when position deviation is equal to or less than Pn060 for position control. Undefined when not using position control.					
			2	VCMP output. Turn ON when the deviation between the Servomotor speed and commanded speed is within the range set by Pn061 for speed control. Undefined when not using speed control.					
			3	TGON output. Turn ON when the absolute value of the Servomotor speed exceeds Pn062 setting in all control modes.					
			4	READY output. Turn ON when the main power is supplied, there is no alarm, and Servo SYNC with a host controller is established in all control modes.					
			5	CLIM output. Turn ON when torque limit is activated in all control modes.					
			6	VLIM output. Turn ON when the Servomotor speed reaches the speed limit for torque control. Undefined when not using torque control.					
			7	BKIR output. Turn ON with the release timing of the brake release signal in all control modes.					
			8	WARN output. Turn ON when a warning is issued in all control modes.					
			9	INP2 output. Turn ON when the position deviation is equal to or less than the Positioning Completion Range 2 (Pn063) for position control. Undefined when not using position control.					
Pn113	General-purpose Output 2 Function Selection	2	Selects the function for general-purpose output 2 (OUTM2). The set values and the functions are the same as for general-purpose output 1 (OUTM1).		0	---	0 to 9	Offline	
Pn114	General-purpose Output 3 Function Selection	2	Selects the function for general-purpose output 3 (OUTM3). The set values and the functions are the same as for general-purpose output 1 (OUTM1).		0	---	0 to 9	Offline	
Pn115 to Pn13F	Reserved	---	Do not change.		0	---	---	---	
Pn200	Absolute Origin Offset	4	Sets the offset amount for the encoder position and the mechanical coordinate system position when using an absolute encoder.		0	Command units	–1073741823 to 1073741823	Offline	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn201</td><td>Forward Software Limit</td><td>4</td><td colspan="2">Sets the soft limit in the forward direction.
If the Servomotor exceeds the limit, the network response status (PSOT) will turn ON (=1).
Note Be sure to set the limits so that Forward Software Limit > Reverse Software Limit.
Note PSOT is not turned ON when origin return is incomplete.</td><td>500000</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td></td></tr>
<tr><td>Pn202</td><td>Reverse Software Limit</td><td>4</td><td colspan="2">Sets the soft limit for the reverse direction.
If the Servomotor exceeds the limit, the network response status (NSOT) will turn ON (=1).
Note Be sure to set the limits so that Forward Software Limit > Reverse Software Limit.
Note NSOT is not turned ON when origin return is incomplete.</td><td>–500000</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td></td></tr>
<tr><td>Pn203</td><td>Final Distance for External Input Positioning</td><td>4</td><td colspan="2">Sets the distance to travel after detecting the latch signal input position when performing external input positioning.
The operation after detecting the latch signal input position will be determined by the external input positioning direction and this parameter as follows.
<table><tr><th rowspan="2">External input positioning direction</th><th colspan="2">Sign</th></tr><tr><th>Positive</th><th>Negative</th></tr><tr><td>Positive direction</td><td>Moves in the positive direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the negative direction and stops</td></tr><tr><td>Negative direction</td><td>Decelerates to a stop, reverses, then moves in the positive direction and stops</td><td>Moves in the negative direction and stops*1</td></tr></table>*1. Reverses after decelerating to a stop if the final distance for external input positioning is short in comparison to the deceleration distance.</td><td>100</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn204</td><td>Origin Return Final Distance</td><td>4</td><td colspan="2">Sets the distance from the latch signal input position to the origin when performing origin return.
The operation after detecting the latch signal input position will be determined by the origin return direction and this parameter as follows.
<table><tr><th rowspan="2">Origin return direction</th><th colspan="2">Sign</th></tr><tr><th>Positive</th><th>Negative</th></tr><tr><td>Positive direction</td><td>Moves in the positive direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the negative direction and stops</td></tr><tr><td>Negative direction</td><td>Moves in the negative direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the positive direction and stops</td></tr></table>*1. Reverses after decelerating to a stop if the final travel distance for origin return is short in comparison to the deceleration distance.</td><td>100</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td></tr>
<tr><td>Pn205</td><td>Electronic Gear Ratio 1 (Numerator)</td><td>4</td><td colspan="2">Sets the numerator for the electronic gear ratio.
Setting this parameter to 0 automatically sets the encoder resolution as the numerator. (131072 for a 17-bit absolute encoder, or 10000 for a 2,500-p/r incremental encoder).
Note Set the electronic gear ratio within the range of 1/100 to 100 times. A parameter setting alarm (alarm code 93) will occur if the ratio is set outside of this range.</td><td>1</td><td>---</td><td>0 to 131072</td><td>Offline</td><td></td></tr>
<tr><td>Pn206</td><td>Electronic Gear Ratio 2 (Denominator)</td><td>4</td><td colspan="2">Sets the denominator for the electronic gear ratio.
Note Set the electronic gear ratio within the range of 1/100 to 100 times. A parameter setting alarm (Alarm code 93) will occur if the ratio is set outside of this range.</td><td>1</td><td>---</td><td>1 to 65535</td><td>Offline</td><td></td></tr>
<tr><td>Pn207</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn208</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn209</td><td>Deviation Counter Overflow Level</td><td>4</td><td colspan="2">Sets the deviation counter overflow level.
The value will become saturated at 134217728 (= 2^{27}) pulses after multiplying with the electronic gear ratio.
Setting this parameter to 0 will disable deviation counter overflow.</td><td>20000</td><td>Command units</td><td>0 to 2147483647</td><td>Online</td><td></td></tr>
<tr><td>Pn20A to Pn21F</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
</table>

4-5-2 W-series Servo Drives (R88D-WT□ with JUSP-NS115)

The Servo Parameters listed here can be used when the Position Control Unit is used with an OMRON W-series Servo Drive (R88D-WT□) with a Yaskawa MECHATROLINK-II Application Module (JUSP-NS115).

For further details on each of the parameters, refer to the user's manuals for W-series Servo Drives and MECHATROLINK-II Application Modules (JUSP-NS115).

The default settings for parameters Pn000 to Pn601 in the parameter tables for the R88D-WT□ W-series Servo Drive used with the JUSP-NS115 are automatically set to the default parameter settings for when the JUSP-NS115 MECHATROLINK-II Application Module is mounted to a W-series Servo Drive. Parameters from Pn800 onwards are enabled when the JUSP-NS115 is mounted. The parameter names and default settings for these parameters follow those specified by the JUSP-NS115.

The timing for Servo Parameters to be enabled are classified into the following two types.

Online (online parameter): Changed settings are enabled immediately after Servo Parameters have been written.

Offline (offline parameters): Changed settings are enabled when the Servo Drive power is cycled or DEVICE SETUP is executed.

The *Details* column indicates whether the following conditions apply to the corresponding parameter.

- Online parameters that can be changed when the axis is stopped (Busy Flag = 0) only.
- Parameters that are automatically set when a JUSP-NS115 MECHATROLINK-II Application Module is installed and Parameters that are used with fixed set values are indicated in the *Details* column as "fixed" with the set value.
- Parameters with standard set values when using MECHATROLINK are indicated in the *Details* column as "standard" with the set value. The standard settings are basic settings required when using the Position Control Unit. This manual describes operations assuming standard settings are being used.

For details on fixed and standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

Note Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Drive's user's manual and always check the effect of changing the settings before changing the Servo Parameters.

Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switch	2	0	Reverse rotation	0	CCW direction is taken for positive command.	0	---	---	Offline	---
					1	CW direction is taken for positive command.					
			1	Not used.	1	The setting is disabled. (Do not change the setting.)	1	---	---	---	---
			2	Unit No. setting	0 to F	Servo Drive communications unit number setting when using personal computer monitoring software	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn001	Function selection application switch 1	2	0	Select stop if an alarm occurs when Servomotor is OFF	0	Servomotor stopped by dynamic brake.	2	---	---	Offline	---
					1	Servomotor stopped by dynamic brake. Dynamic brake released after stopping.					
					2	Servomotor stopped with free run.					
			1	Select stop when prohibited drive is input	0	Stop according to Pn001.0 settings (release Servomotor after stopping).	0	---	---	Offline	---
					1	Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping.					
					2	Stop Servomotor using torque set in Pn406, and release Servomotor after stopping.					
			2	Select AC/DC power input	0	AC power supply: AC power supplied from L1, L2, (L3) terminals	0	---	---	Offline	---
					1	DC power supply: DC power supplied from +1, – terminals					
			3	Select warning code output	0	Alarm code only output from ALO1, ALO2, ALO3	1	---	---	Offline	---
					1	Alarm code and warning code both output from ALO1, ALO2, ALO3					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn002	Function selection application switch 2	2	0	Torque command input change (during speed control)	0	Option command value not used.	0	---	---	Offline	---
					1	Option command value 1 used as torque limit input.					
					2	Option command value 1 used as the torque feed forward input.					
					3	Option command values 1 and 2 used as torque limit inputs according to the forward/reverse rotation current limit setting.					
			1	Speed command input change (during torque control)	0	Option command value not used.	0	---	---	Offline	---
					1	Option command value 1 used as speed limit input.					
			2	Operation switch when using absolute encoder	0	Use as absolute encoder.	0	---	---	Offline	---
					1	Use as incremental encoder.					
			3	Fully-closed encoder usage method	0	Fully-closed encoder is not used.	0	---	---	Offline	---
					1	Fully-closed encoder is used without phase Z.					
					2	Fully-closed encoder is used with phase Z.					
					3	Fully-closed encoder is used in Reverse Rotation Mode without phase Z.					
					4	Fully-closed encoder is used in Reverse Rotation Mode with phase Z.					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn003	Function selection application switch 3	2	0	Analog monitor 1 (AM) allocation	0	Servomotor rotation speed: 1 V/1,000 r/min	2	---	---	Online	---
					1	Speed command: 1 V/1,000 r/min					
					2	Torque command: 1 V/100%					
					3	Position deviation: 0.05 V/1 command unit					
					4	Position deviation: 0.05 V/100 command units					
					5	Command pulse frequency: 1 V/1,000 r/min					
					6	Servomotor rotation speed: 1 V/250 r/min					
					7	Servomotor rotation speed: 1 V/125 r/min					
					8 to F	Not used.					
			1	Analog monitor 2 (NM) allocation	0 to F	Same as Pn003.0	0	---	---	Online	---
			2 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn004	Not used.	---	---	---	---	(Do not change the setting.)	0200	---	---	---	Fixed setting: 0200
Pn005	Not used.	---	---	---	---	(Do not change the setting.)	0000	---	---	---	---

Servo Gain Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn100	Speed loop gain	2	Adjusts speed loop responsiveness.				80	Hz	1 to 2000	Online	---
Pn101	Speed loop integration constant	2	Speed loop integral time constant				2000	×0.01 ms	15 to 51200	Online	---
Pn102	Position loop gain	2	Adjusts position loop responsiveness.				40	1/s	1 to 2000	Online	---
Pn103	Inertia ratio	2	Sets using the ratio between the machine system inertia and the Servomotor rotor inertia.				300	%	0 to 20000	Online	---
Pn104	Speed loop gain 2	2	Adjusts speed loop responsiveness (enabled by automatic gain switching input).				80	Hz	1 to 2000	Online	---
Pn105	Speed loop integration constant 2	2	Speed loop integral time constant (enabled by automatic gain switching input)				2000	×0.01 ms	15 to 51200	Online	---
Pn106	Position loop gain 2	2	Adjusts position loop responsiveness (enabled by automatic gain switching input).				40	1/s	1 to 2000	Online	---
Pn107	Bias rotational speed	2	Sets position control bias.				0	r/min	0 to 450	Online	---
Pn108	Bias addition band	2	Sets the position control bias operation start using deviation counter pulse width.				7	Command unit	0 to 250	Online	---
Pn109	Feed-forward amount	2	Position control feed-forward compensation value				0	%	0 to 100	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn10A	Feed-forward command filter	2	Sets position control feed-forward command filter.				0	×0.01 ms	0 to 6400	Online	---
Pn10B	Speed control setting	2	0	P control switching conditions	0	Sets internal torque command value conditions (Pn10C).	4	---	---	Online	---
					1	Sets speed command value conditions (Pn10D).					
					2	Sets acceleration command value conditions (Pn10E).					
					3	Sets deviation pulse value conditions (Pn10F).					
					4	No P control switching function					
			1	Speed control loop switching	0	PI control	0	---	---	Offline	---
					1	IP control					
			2	Automatic gain switching	0	Automatic gain switching disabled	0	---	---	Offline	---
					1	Gain switching using position commands					
					2	Gain switching using position deviation					
					3	Gain switching using position commands and position deviation					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn10C	P control switching (torque command)	2	Sets level of torque command to switch from PI control to P control.				200	%	0 to 800	Online	---
Pn10D	P control switching (speed command)	2	Sets level of speed command to switch from PI control to P control.				0	r/min	0 to 10000	Online	---
Pn10E	P control switching (acceleration command)	2	Sets level of acceleration command to switch from PI control to P control.				0	10 r/min/s	0 to 3000	Online	---
Pn10F	P control switching (deviation pulse)	2	Sets level of deviation pulses to switch from PI control to P control.				10	Command unit	0 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn110	Online autotuning setting	2	0	Select online autotuning	0	Autotunes initial operations only after power is turned ON.	2	---	---	Offline	---
					1	Always autotunes.					
					2	No autotuning					
			1	Select speed feedback compensation function	0	ON	1	---	---	Online	---
					1	OFF					
			2	Select adhesive friction compensation function	0	Friction compensation: OFF	0	---	---	Online	---
					1	Friction compensation: Rated torque ratio small					
					2	Friction compensation: Rated torque ratio large					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn111	Speed feedback compensation gain	2	Adjusts speed loop feedback gain.				100	%	1 to 500	Online	---
Pn112 to Pn123	Not used.	---	(Do not change the setting.)				---	---	---	---	---
Pn124	Automatic gain switching timer	2	Sets the switching delay after conditions have been met, when the automatic gain switching function is used. (Pn10B.2 = 1 to 3).				100	ms	1 to 10000	Online	---
Pn125	Automatic gain switching width (amount of position deviation)	2	Sets the position deviation used as the switching condition when the automatic gain switching function by position deviation (Pn10B.2 = 2, 3) is used.				7	Command unit	1 to 250	Online	---

Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn200	Position control setting 1	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn201	Encoder divider rate	2	Sets the number of output pulses from the Servo Drive.				1000	Pulses /rotation	16 to 16384	Offline	---
Pn202	Electronic gear ratio G1 (numerator)	2	Sets the pulse rate for the command pulses and Servomotor travel distance. $0.01 \leq G1/G2 \leq 100$				4	---	1 to 65535	Offline	---
Pn203	Electronic gear ratio G2 (denominator)	2					1	---	1 to 65535	Offline	---
Pn204	Not used.	---	(Do not change the setting.)				0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn205	Absolute encoder multi-turn limit setting	2	Sets the limit to the rotation speed when using a Servomotor with an absolute encoder.				65535	Rotations	0 to 65535	Offline	---
Pn206	Number of fully-closed encoder pulses	2	Sets the number of fully-closed encoder pulses for each motor rotation.				16384	Pulses /rotation	513 to 32768	Offline	---
Pn207	Position control setting 2	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn208	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn212	Not used.	---	(Do not change the setting.)				2048	---	---	---	---
Pn217	Not used.	---	(Do not change the setting.)				1	---	---	---	---
Pn218	Position control setting 3	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Speed Control Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn300	Not used.	---	(Do not change the setting.)	1000	---	---	---	---
Pn301	Not used.	---	(Do not change the setting.)	100	---	---	---	---
Pn302	Not used.	---	(Do not change the setting.)	200	---	---	---	---
Pn303	Not used.	---	(Do not change the setting.)	300	---	---	---	---
Pn304	Jog speed	2	Sets the rotation speed used during jog operation (executed from the Servo Drive's Parameter Unit).	500	r/min	0 to 10000	Online	---
Pn305	Soft start acceleration time	2	Sets acceleration time during speed control soft start.	0	ms	0 to 10000	Online	---
Pn306	Soft start deceleration time	2	Sets deceleration time during speed control soft start.	0	ms	0 to 10000	Online	---
Pn307	Not used.	---	(Do not change the setting.)	40	---	---	---	---
Pn308	Speed feedback filter time constant	2	Sets filter time constant for speed feedback.	0	×0.01 ms	0 to 65535	Online	---
Pn309	Not used.	---	(Do not change the setting.)	60	---	---	---	---

Torque Control (Torque Limit) Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn400	Not used.	---	(Do not change the setting.)				30	---	---	---	---
Pn401	Torque command filter time constant	2	Sets the filter time constant for the internal torque command.				40	×0.01 ms	0 to 65535	Online	---
Pn402	Forward torque limit	2	Forward rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn403	Reverse torque limit	2	Reverse rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn404	Forward rotation external current limit	2	Output torque limit during input of forward rotation current limit (rated torque ratio).				100	%	0 to 800	Online	---
Pn405	Reverse rotation external current limit	2	Output torque limit during input of reverse rotation current limit (rated torque ratio).				100	%	0 to 800	Online	---
Pn406	Emergency stop torque	2	Deceleration torque when an error occurs (rated torque ratio).				350	%	0 to 800	Online	---
Pn407	Speed limit	2	Sets the speed limit in torque control mode.				3000	r/min	0 to 10000	Online	---
Pn408	Torque command setting	2	0	Selects notch filter 1 function	0	Notch filter 1 not used.	0	---	---	Online	---
					1	Notch filter 1 used for torque commands.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Selects notch filter 2 function	0	Notch filter 2 not used.	0	---	---	Online	---
					1	Notch filter 2 used for torque commands.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn409	Notch filter 1 frequency	2	Sets notch filter 1 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40A	Notch filter 1 Q value	2	Sets Q value of notch filter 1.				70	×0.01	50 to 400	Online	---
Pn40B	Notch filter 2 frequency	2	Sets notch filter 2 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40C	Notch filter 2 Q value	2	Sets Q value of notch filter 2.				70	×0.01	50 to 400	Online	---

I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn500	Positioning completion range 1	2	Sets the width of the positioning completed range.				3	Command unit	0 to 250	Online	---
Pn501	Not used.	---	(Do not change the setting.)				10	---	---	---	---
Pn502	Rotation speed for motor rotation detection	2	Sets the number of rotations for detecting the Zero Speed Flag.				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag.				10	r/min	0 to 100	Online	---
Pn504	Positioning completion range 2	2	Sets the proximity range for the Positioning Proximity Flag.				3	Command unit	1 to 250	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn505	Deviation counter overflow level	2	Sets the detection level for the deviation counter over alarm.				1024	×256 pulses	1 to 32767	Online	---
Pn506	Brake timing 1	2	Sets the delay from the brake command to the Servomotor turning OFF.				0	×10 ms	0 to 50	Online	---
Pn507	Brake command speed	2	Sets the rotation speed for outputting the brake command.				100	r/min	0 to 10000	Online	---
Pn508	Brake timing 2	2	Sets the delay from the Servomotor turning OFF to the brake command output.				50	×10 ms	10 to 100	Online	---
Pn509	Momentary hold time	2	Sets the time during which alarm detection is disabled when a power failure occurs.				20	ms	20 to 1000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selection 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	POT (forward drive prohibited input) signal input terminal allocation	0	Allocated to CN1, pin 40: Valid for low input	8	---	---	Offline	Standard setting: 2
					1	Allocated to CN1, pin 41: Valid for low input					
					2	Allocated to CN1, pin 42: Valid for low input					
					3	Allocated to CN1, pin 43: Valid for low input					
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always valid.					
					8	Always invalid.					
					9	Allocated to CN1, pin 40: Valid for high input					
					A	Allocated to CN1, pin 41: Valid for high input					
					B	Allocated to CN1, pin 42: Valid for high input					
					C	Allocated to CN1, pin 43: Valid for high input					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50B	Input signal selection 2	2	0	NOT (reverse drive prohibited input) signal input terminal allocation	0 to F	Same as Pn50A.3	8	---	---	Offline	Standard setting: 3
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	PCL (forward rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	5	---	---	Offline	Standard setting: 8
			3	NCL (reverse rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	6	---	---	Offline	Standard setting: 8
Pn50C	Input signal selection 3	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
Pn50D	Input signal selection 4	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50E	Output signal selection 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	Not used.	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pins 25, 26					
					2	Allocated to CN1, pins 27, 28					
					3	Allocated to CN1, pins 29, 30					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0	1	---	---	Offline	Standard setting: 0
			2	TGON (Servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	2	---	---	Offline	Standard setting: 0
			3	READY (Servomotor warmup complete) signal output terminal allocation	0 to 3	Same as Pn50E.0	3	---	---	Offline	Standard setting: 3

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50F	Output signal selection 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 2
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
Pn510	Output signal selection 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selection 5	2	0	DEC signal input terminal allocation	0	Allocated to CN1, pin 40: Valid for low input	8	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pin 41: Valid for low input					
					2	Allocated to CN1, pin 42: Valid for low input					
					3	Allocated to CN1, pin 43: Valid for low input					
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 40: Valid for high input					
					A	Allocated to CN1, pin 41: Valid for high input					
					B	Allocated to CN1, pin 42: Valid for high input					
					C	Allocated to CN1, pin 43: Valid for high input					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selection 5	2	1	EXT1 signal input terminal allocation	0 to 3	Always disabled.	8	---	---	Offline	Standard setting: 4
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9 to C	Always disabled.					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					
			2	EXT2 signal input terminal allocation	0 to F	Same as Pn511.1	8	---	---	Offline	Standard setting: 5
			3	EXT3 signal input terminal allocation	0 to F	Same as Pn511.1	8	---	---	Offline	Standard setting: 6
Pn512	Output signal reverse	2	0	Output signal reverse for CN1 pins 25, 26	0	Not reversed.	0	---	---	Offline	---
					1	Reversed.					
			1	Output signal reverse for CN1 pins 27, 28	0, 1	Same as above	0	---	---	Offline	---
			2	Output signal reverse for CN1 pins 29, 30	0, 1	Same as above	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn513	Input signal selection 6	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn51A	Motor-load deviation over level	2	Sets the allowable range for the number of pulses for fully-closed encoders and semi-closed encoders.				0	Pulse	0 to 32767	Online	---
Pn51B	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn51C	Not used.	---	(Do not change the setting.)				450	---	---	---	---
Pn51E	Deviation counter overflow warning level	2	Sets the detection level for the deviation counter overflow warning.				0	%	0 to 100	Online	---

Other Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn600	Regeneration resistor capacity	2	Setting for the regeneration resistance load ratio monitoring calculations.	0	×10 W	From 0 (Varies by Unit.)	Online	---
Pn601	Not used.	---	(Do not change the setting.)	0	---	---	---	---

Control Function Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	MECHATROLINK-II communications check mask	0	Detects both communications errors (A.E6) and synchronization errors (A.E5).	0	---	---	Online	Always set to 0.
					1	Ignores communications errors (A.E6).					
					2	Ignores synchronization errors (A.E5).					
					3	Ignores both communications errors (A.E6) and synchronization errors (A.E5).					
			1	Warning check mask	0	Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameters setting warnings (A.94).					
					2	Ignores MECHATROLINK-II command warnings (A.95).					
					3	Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95).					
					4	Ignores communications errors (A.96).					
					5	Ignores both parameter setting warnings (A.94) and communications errors (A.96).					
					6	Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96).					
					7	Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96).					
			2	Communications error count at single transmission	0 to F	Detects a communications error (A.E6) when the number of errors specified by the set value + 2 have occurred continuously.	0	---	---	Online	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Function selection application (software limits)	2	0	Software limit function	0	Software limit enabled.	0	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Software limit disabled in both directions.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using references	0	No software limit check using references.	0	---	---	Online	Always set to 0.
					1	Software limit check using references.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn802	Not used.	---	(Do not change the setting.)	0000	---	---	---	---
Pn803	Zero point width	2	Sets the detection range for the Origin Stop Flag.	10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the forward software limit.	819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the reverse software limit.	−819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn808	Absolute encoder zero point position offset	4	Sets the offset for the mechanical origin from the absolute encoder's absolute value data.	0	Command unit	−1,073,741,823 to 1,073,741,823	Offline	---
Pn80A	First-step linear acceleration constant	2	Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80B	Second-step linear acceleration constant	2	Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80C	Acceleration constant switching speed	2	Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn80D	First-step linear deceleration constant	2	Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Second-step linear deceleration constant	2	Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80F	Deceleration constant switching speed	2	Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn810	Exponential acceleration/ deceleration bias	2	Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control.	0	Command units/s	0 to 32767	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn811	Exponential acceleration/ deceleration time constant	2	Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn812	Movement average time	2	Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn813	Not used.	---	(Do not change the setting.)	0010	---	---	---	---
Pn814	Final travel distance for external positioning	4	Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation.	100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode setting	2	0	Zero point return direction	0	Forward	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search.				100	Command unit	–1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn81B	Backlash compensation amount	2	Sets the amount of backlash compensation.				0	× 0.1 command unit	–32,768 to 32,767	Online	---
Pn81C	Not used.	---	(Do not change the setting.)				0000	---	---	---	---
Pn81D	Compensation function selection	2	0	Backlash compensation selection	0	Compensates in forward direction.	0	---	---	Offline	---
					1	Compensates in reverse direction.					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn81E to Pn823	Not used.	---	(Do not change the setting.)				0000	---	---	---	---

4-5-3 W-series Servo Drive (R88D-WN□-ML2 with Built-in MECHATROLINK-II Communications)

The Servo Parameters listed here can be used when the Position Control Unit is used with a W-series Servo Drive with Built-in MECHATROLINK-II Communications (R88D-WN□-ML2).

For further details on each of the parameters, refer to the user's manual for W-series Servo Drives.

The timing for Servo Parameters to be enabled are classified into the following two types.

Online (online parameter): Changed settings are enabled immediately after Servo Parameters have been written.

Offline (offline parameters): Changed settings are enabled when the Servo Drive power is cycled or DEVICE SETUP is executed.

The *Details* column indicates whether the following conditions apply to the corresponding parameter.

- Online parameters that can be changed when the axis is stopped (Busy Flag = 0) only.
- Parameters with standard set values when using MECHATROLINK are indicated in the *Details* column as "standard" with the set value. The standard settings are basic settings required when using the Position Control Unit. This manual describes operations assuming standard settings are being used.

For details on fixed and standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

Note Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Drive's user's manual and always check the effect of changing the settings before changing the Servo Parameters.

Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switches	2	0	Reverse rotation	0	CCW direction is taken for positive command	0	---	---	Offline	---
					1	CW direction is taken for positive command					
					2 to 3	Not used.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Unit No. setting	0 to F	Servo Drive communications unit number setting (necessary for multiple Servo Drive connections when using personal computer monitoring software)	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn001	Function selection application switches 1	2	0	Stop selection if an alarm occurs when Servomotor is OFF	0	Servomotor stopped by dynamic brake.	2	---	---	Offline	---
					1	Dynamic brake OFF after Servomotor stopped					
					2	Servomotor stopped with free run					
			1	Stop selection when drive prohibited is input	0	Stop according to Pn001.0 setting (release Servomotor after stopping)	0	---	---	Offline	---
					1	Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping					
					2	Stop Servomotor using torque set in Pn406, and release Servomotor after stopping					
			2	AC/DC power input selection	0	AC power supply: AC power supplied from L1, L2, (L3) terminals	0	---	---	Offline	---
					1	DC power supply: DC power from +, – (2) terminals					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn002	Function selection application switches 2	2	0	Torque command input change (during speed control)	0	Do not use option command value.	0	---	---	Offline	---
					1	Use option command value 1 as the torque limit value.					
					2	Use option command value 1 as the torque feed forward command value.					
					3	Use option command value 1 or 2 as the torque limit value, according to the forward and reverse torque limits that are specified.					
			1	Speed command input change (during torque control)	0	Do not use option command value.	0	---	---	Offline	---
					1	Use option command value 1 as the speed limit value.					
			2	Operation switch when using absolute encoder	0	Use as absolute encoder.	0	---	---	Offline	---
					1	Use as incremental encoder.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn004	Function selection application switches 4	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn006	Function selection application switches 6	2	0 to 1	Analog monitor 1 (AM) signal selection	00	Servomotor rotation speed: 1 V/1000 r/min	02	---	---	Online	---
					01	Speed command: 1 V/1000 r/min					
					02	Torque command: gravity compensation torque (Pn422) (1 V per 100%)					
					03	Position deviation: 0.05 V/1 command unit					
					04	Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit)					
					05	Position command speed (1 V/1,000 r/min)					
					06	Not used.					
					07	Not used.					
					08	Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V					
					09	Speed feed forward (1 V/1,000 r/min)					
					0A	Torque feed forward (1 V per 100%)					
					0B to 1F	Not used.					
			2	Analog monitor 1 signal multiplier selection	0	1x	0	---	---	Online	---
					1	10x					
					2	100x					
					3	1/10x					
					4	1/100x					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn007	Function selection application switches 7	2	0 to 1	Analog monitor 2 (NM) signal selection	00	Servomotor rotation speed: 1V/1000 r/min	00	---	---	Online	---
					01	Speed command: 1 V/1000 r/min					
					02	Torque command: gravity compensation torque (Pn422) (1 V per 100%)					
					03	Position deviation: 0.05 V/1 command unit					
					04	Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit)					
					05	Position command speed (1 V/1,000 r/min)					
					06	Not used.					
					07	Not used.					
					08	Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V					
					09	Speed feed forward (1 V/1,000 r/min)					
					0A	Torque feed forward (1 V per 100%)					
					0B to 1F	Not used.					
			2	Analog monitor 2 signal multiplier selection	0	1x	0	---	---	Online	---
					1	10x					
					2	100x					
					3	1/10x					
					4	1/100x					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn008	Function selection application switches 8	2	0	Lowered battery voltage alarm/warning selection	0	Regard battery voltage drop as alarm (A.830).	0	---	---	Offline	---
					1	Regard battery voltage drop as warning (A.930).					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Warning detection selection	0	Warnings detected.	0	---	---	Offline	---
					1	Warnings not detected.					
			3	Not used.	4	(Do not change the setting.)	4	---	---	---	---

Servo Gain Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn100	Speed loop gain	2	Adjusts speed loop response.				800	× 0.1 Hz	10 to 20000	Online	---
Pn101	Speed loop integration constant	2	Speed loop integral time constant				2000	×0.01 ms	15 to 51200	Online	---
Pn102	Position loop gain	2	Adjusts position loop response.				400	× 0.1/s	10 to 20000	Online	---
Pn103	Inertia ratio	2	Set using the ratio between the machine system inertia and the Servomotor rotor inertia.				300	%	0 to 20000	Online	---
Pn104	Speed loop gain 2	2	Adjusts speed loop response (enabled by automatic gain switching input).				800	× 0.1 Hz	10 to 20000	Online	---
Pn105	Speed loop integration constant 2	2	Speed loop integral time constant (enabled by automatic gain switching input).				2000	×0.01 ms	15 to 51200	Online	---
Pn106	Position loop gain 2	2	Adjusts position loop response (enabled by automatic gain switching input).				400	× 0.1/s	10 to 20000	Online	---
Pn107	Bias rotational speed	2	Sets position control bias.				0	r/min	0 to 450	Online	---
Pn108	Bias addition band	2	Sets the position control bias operation start using deviation counter pulse width.				7	Command unit	0 to 250	Online	---
Pn109	Feed-forward amount	2	Position control feed-forward compensation value				0	%	0 to 100	Online	---
Pn10A	Feed-forward command filter	2	Sets position control feed-forward command filter.				0	×0.01 ms	0 to 6400	Online	---
Pn10B	Speed control setting	2	0	P control switching conditions	0	Sets internal torque command value conditions (Pn10C).	4	---	---	Online	---
					1	Sets speed command value conditions (Pn10d).					
					2	Sets acceleration command value conditions (Pn10E).					
					3	Sets deviation pulse value conditions (Pn10F).					
					4	No P control switching function					
			1	Speed control loop switching	0	PI control	0	---	---	Offline	---
					1	IP control					
					2 to 3	Not used.					
			2	Position loop control method	0	Standard position control	0	---	---	Offline	---
					1	Less deviation control					
					2 to 3	Not used.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn10C	P control switching (torque command)	2	Sets level of torque command to switch from PI control to P control.				200	%	0 to 800	Online	---
Pn10D	P control switching (speed command)	2	Sets level of speed command to switch from PI control to P control.				0	r/min	0 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn10E	P control switching (acceleration command)	2	Sets level of acceleration command to switch from PI control to P control.				0	r/min/s	0 to 30000	Online	---
Pn10F	P control switching (deviation pulse)	2	Sets level of deviation pulses to switch from PI control to P control.				10	Command unit	0 to 10000	Online	---
Pn110	Normal autotuning switches	2	0	Not used.	2	(Do not change the setting.)	2	---	---	Offline	---
			1	Speed feedback compensation function selection	0	ON	1	---	---	Online	---
					1	OFF					
					2 to 3	Not used.					
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn111	Speed feedback compensating gain	2	Adjusts speed loop feedback gain.				100	%	1 to 500	Online	---
Pn119	Not used.	---	(Do not change the setting.)				500	---	---	---	---
Pn11A	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn11E	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn11F	Position integral time constant	2	Position loop integral time constant				0	× 0.1 ms	0 to 50000	Online	---
Pn12B	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12C	Not used.	---	(Do not change the setting.)				2000	---	---	---	---
Pn12D	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12E	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12F	Not used.	---	(Do not change the setting.)				2000	---	---	---	---
Pn130	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn131	Gain switching time 1	2	Switching time from No. 1 gain to No. 2 gain				0	ms	0 to 65535	Online	---
Pn132	Gain switching time 2	2	Switching time from No. 2 gain to No. 1 gain				0	ms	0 to 65535	Online	---
Pn135	Gain switching waiting time 1	2	The time from when gain switching condition A is satisfied until switching from the No. 1 gain to the No. 2 gain begins.				0	ms	0 to 65535	Online	---
Pn136	Gain switching waiting time 2	2	The time from when gain switching condition B is satisfied until switching from the No. 2 gain to the No. 1 gain begins.				0	ms	0 to 65535	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn139	Automatic gain changeover related switches 1	2	0	Gain switching selection switch	0	Manual gain switching (automatic gain switching not used)	0	---	---	Offline	---
					1	Automatic switching pattern 1 Automatic switching from No. 1 gain to No. 2 gain when gain switching condition A is satisfied. Automatic switching from No. 2 gain to No. 1 gain when gain switching condition B is satisfied.					
					2 to 4	Not used.					
			1	Gain switching condition A	0	Positioning completed output 1 (INP1) ON	0	---	---	Offline	---
					1	Positioning completed output 1 (INP1) OFF					
					2	Positioning completed output 2 (INP2) ON					
					3	Positioning completed output 2 (INP2) OFF					
					4	The position command filter output is 0, and also the position command input is 0.					
					5	The position command input is not 0.					
			2	Gain switching condition B	0 to 5	Same as Pn139.1	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn144	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn150	Predictive control selection switches	2	0	Predictive control selection	0	Predictive control not used.	0	---	---	Offline	---
					1	Predictive control used.					
					2	Not used.					
			1	Predictive control type	0	Predictive control for tracking	1	---	---	Offline	---
					1	Predictive control for positioning					
			2	Not used.	2	(Do not change the setting.)	2	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn151	Predictive control acceleration/deceleration gain	2	Adjusts acceleration and deceleration response for predictive control.				100	%	0 to 300	Online	---
Pn152	Predictive control weighting ratio	2	Adjusts position deviation for predictive control.				100	%	0 to 300	Online	---
Pn1A0	Servo rigidity	2	Adjusts the Servo rigidity for the No. 1 gain.				60	%	1 to 500	Online	---
Pn1A1	Servo rigidity 2	2	Adjusts the Servo rigidity for the No. 2 gain.				60	%	1 to 500	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn1A2	Speed feedback filter time constant	2	Sets the filter time constant for No. 1 gain speed feedback.				72	× 0.01 ms	30 to 3200	Online	---
Pn1A3	Speed feedback filter time constant 2	2	Sets the filter time constant for No. 2 gain speed feedback.				72	× 0.01 ms	30 to 3200	Online	---
Pn1A4	Torque command filter time constant 2	2	Sets the filter time constant for the torque command.				36	× 0.01 ms	0 to 2500	Online	---
Pn1A7	Utility control switches	2	0	Integral compensation processing	0	Integral compensation processing not executed.	1	---	---	Online	---
					1	Integral compensation processing executed.					
					2	Integral compensation is executed for No. 1 gain and not for No. 2 gain for less-deviation gain switching.					
					3	Integral compensation is executed for No. 2 gain and not for No. 1 gain for less-deviation gain switching.					
			1	Not used.	2	(Do not change the setting.)	2	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	1	(Do not change the setting.)	1	---	---	---	---
Pn1A9	Utility integral gain	2	Adjusts the auxiliary integral responsive.				37	Hz	0 to 500	Online	---
Pn1AA	Position proportional gain	2	Adjusts the position proportional responsive.				60	Hz	0 to 500	Online	---
Pn1AB	Speed integral gain	2	Adjusts the speed integral responsive.				0	Hz	0 to 500	Online	---
Pn1AC	Speed proportional gain	2	Adjusts the speed proportional responsive.				120	Hz	0 to 2000	Online	---
Pn1B5	Not used.	---	(Do not change the setting.)				150	---	---	---	---

Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn200	Not used.	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn205	Absolute encoder multi-turn limit setting	2	Sets the multi-turn limit for when a Servomotor with an absolute encoder is used.				65535	Rotation	0 to 65535	Offline	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn207	Position control settings 2	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Backlash compensation selection	0	Disabled	0	---	---	Offline	---
					1	Compensates to forward rotation side.					
					2	Compensates to reverse rotation side.					
			3	INP 1 output timing	0	When the position deviation is below the INP1 range (Pn522).	0	---	---	Offline	---
					1	When the position deviation is below the INP1 range (Pn522) and also the command after the position command filter is 0.					
					2	When the absolute value for the position deviation is below the INP1 range (Pn522) and also the position command input is 0.					
Pn209	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn20A	Not used.	---	(Do not change the setting.)				32768	---	---	---	---
Pn20E	Electronic gear ratio G1 (numerator)	4	Sets the pulse rate for the command pulses and Servomotor movement distance. 0.001 ≤ G1/G2 ≤ 1000				4	---	1 to 1073741824	Offline	---
Pn210	Electronic gear ratio G2 (denominator)	4					1	---	1 to 1073741824	Offline	---
Pn212	Encoder divider rate	4	Sets the number of output pulses per Servomotor rotation.				1000	Pulses /rotation	16 to 1073741824	Offline	---
Pn214	Backlash compensation amount	2	Sets mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven)				0	Command unit	–32767 to 32767	Online	---
Pn215	Backlash compensation time constant	2	Sets the backlash compensation time constant.				0	× 0.01 ms	0 to 65535	Online	---
Pn216	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn217	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn281	Not used.	---	(Do not change the setting.)				20	---	---	---	---

Speed Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn300	Not used.	---	(Do not change the setting.)				600	---	---	---	---
Pn301	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn302	Not used.	---	(Do not change the setting.)				200	---	---	---	---
Pn303	Not used.	---	(Do not change the setting.)				300	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn304	Jog speed	2	Sets rotation speed during jog operation (using Servo Drive's personal computer monitoring software)				500	r/min	0 to 10000	Online	---
Pn305	Soft start acceleration time	2	Sets acceleration time during speed control soft start.				0	ms	0 to 10000	Online	---
Pn306	Soft start deceleration time	2	Sets deceleration time during speed control soft start.				0	ms	0 to 10000	Online	---
Pn307	Not used.	---	(Do not change the setting.)				40	---	---	---	---
Pn308	Speed feedback filter time constant	2	Sets constant during filter of speed feedback.				0	× 0.01 ms	0 to 65535	Online	---
Pn310	Vibration detection switches	2	0	Vibration detection selection	0	Vibration detection not used.	0	---	---	Online	---
					1	Gives warning (A.911) when vibration is detected.					
					2	Gives warning (A.520) when vibration is detected.					
			1	Not used.	---	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	---	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	---	(Do not change the setting.)	0	---	---	---	---
Pn311	Vibration detection sensitivity	2	Sets the vibration detection sensitivity.				100	%	50 to 500	Online	---
Pn312	Vibration detection level	2	Sets the vibration detection level				50	r/min	0 to 500	Online	---

Torque Control (Torque Limit) Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn400	Not used.	---	(Do not change the setting.)				30	---	---	---	---
Pn401	1st step 1st torque command filter time constant	2	Sets the filter time constant for internal torque commands.				40	×0.01 ms	0 to 65535	Online	---
Pn402	Forward torque limit	2	Forward rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn403	Reverse torque limit	2	Reverse rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn404	Forward rotation external current limit	2	Output torque limit during input of forward rotation current limit (rated torque ratio)				100	%	0 to 800	Online	---
Pn405	Reverse rotation external current limit	2	Output torque limit during input of reverse rotation current limit (rated torque ratio)				100	%	0 to 800	Online	---
Pn406	Emergency stop torque	2	Deceleration torque when an error occurs (rated torque ratio)				350	%	0 to 800	Online	---
Pn407	Speed limit	2	Sets the speed limit in torque control mode.				3000	r/min	0 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn408	Torque command setting	2	0	Selects notch filter 1 function.	0	Notch filter 1 not used.	0	---	---	Online	---
					1	Notch filter 1 used for torque commands.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Selects notch filter 2 function.	0	Notch filter 2 not used.	0	---	---	Online	---
					1	Notch filter 2 used for torque commands.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn409	Notch filter 1 frequency	2	Sets notch filter 1 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40A	Notch filter 1 Q value	2	Sets Q value of notch filter 1.				70	×0.01	50 to 1000	Online	---
Pn40C	Notch filter 2 frequency	2	Sets the notch filter 2 frequency for torque commands.				2000	Hz	50 to 2000	Online	---
Pn40D	Notch filter 2 Q value	2	Sets Q value of notch filter 2.				70	×0.01	50 to 1000	Online	---
Pn40F	2nd step 2nd torque command filter frequency	2	Sets the filter frequency for internal torque commands.				2000	Hz	100 to 2000	Online	---
Pn410	2nd step 2nd torque command filter Q value	2	Sets the torque command filter Q value.				70	×0.01	50 to 1000	Online	---
Pn411	3rd step torque command filter time constant	2	Sets the filter time constant for internal torque commands.				0	μs	0 to 65535	Online	---
Pn412	1st step 2nd torque command filter time constant	2	Sets the filter time constant for No. 2 gain internal torque commands.				100	× 0.01 ms	0 to 65535	Online	---
Pn413	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn414	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn420	Damping for vibration suppression on stopping	2	Sets the vibration suppression value while stopped.				100	%	10 to 100	Online	---
Pn421	Vibration suppression starting time	2	Sets the time from when the position command becomes 0 until damping for vibration suppression on stopping begins.				1000	ms	0 to 65535	Online	---
Pn422	Gravity compensation torque	2	Sets the gravity compensation torque.				0	×0.01 %	–20000 to 20000	Online	---
Pn456	Sweep torque command amplitude	2	Sets the sweep torque command amplitude.				15	%	1 to 800	Online	---

I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn501	Not used.	---	(Do not change the setting.)				10	---	---	---	---
Pn502	Rotation speed for motor rotation detection	2	Sets the number of rotations for the Servomotor rotation detection output (TGON).				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP).				10	r/min	0 to 100	Online	---
Pn506	Brake timing 1	2	Sets the delay from the brake command to the Servomotor turning OFF.				0	×10 ms	0 to 50	Online	---
Pn507	Brake command speed	2	Sets the number of rotations for outputting the brake command.				100	r/min	0 to 10000	Online	---
Pn508	Brake timing 2	2	Sets the delay time from the Servomotor turning OFF to the brake command output.				50	×10 ms	10 to 100	Online	---
Pn509	Momentary hold time	2	Sets the time during which alarm detection is disabled when a power failure occurs.				20	ms	20 to 1000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selections 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	POT (forward drive prohibited input) signal Input terminal allocation	0	Allocated to CN1, pin 13: Valid for low input	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pin 7: Valid for low input					
					2	Allocated to CN1, pin 8: Valid for low input					
					3	Allocated to CN1, pin 9: Valid for low input					
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 13: Valid for high input					
					A	Allocated to CN1, pin 7: Valid for high input					
					B	Allocated to CN1, pin 8: Valid for high input					
					C	Allocated to CN1, pin 9: Valid for high input					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					
Pn50B	Input signal selections 2	2	0	NOT (reverse drive prohibited input) signal Input terminal allocation	0 to F	Same as Pn50A.3	2	---	---	Offline	Standard setting: 2
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50C	Input signal selections 3	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50D	Input signal selections 4	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50E	Output signal selections 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	Not used.	0	---	---	Offline	Standard setting: 0
					1	Allocated to CN1 pins 1, 2					
					2	Allocated to CN1 pins 23, 24					
					3	Allocated to CN1 pins 25, 26					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	TGON (servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			3	READY (servo ready) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
Pn50F	Output signal selections 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 1
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn510	Output signal selections 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn511	Input signal selections 5	2	0	DEC signal input terminal allocation	0	Allocated to CN1, pin 13: Valid for low input	3	---	---	Offline	Standard setting: 3
					1	Allocated to CN1, pin 7: Valid for low input					
					2	Allocated to CN1, pin 8: Valid for low input					
					3	Allocated to CN1, pin 9: Valid for low input					
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 13: Valid for high input					
					A	Allocated to CN1, pin 7: Valid for high input					
					B	Allocated to CN1, pin 8: Valid for high input					
					C	Allocated to CN1, pin 9: Valid for high input					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selections 5	2	1	EXT1 signal input terminal allocation	0 to 3	Always disabled.	4	---	---	Offline	Standard setting: 4
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9 to C	Always disabled.					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					
			2	EXT2 signal input terminal allocation	0 to F	Same as Pn511.1	5	---	---	Offline	Standard setting: 5
			3	EXT3 signal input terminal allocation	0 to F	Same as Pn511.1	6	---	---	Offline	Standard setting: 6
Pn512	Output signal reverse	2	0	Output signal reverse for CN1 pins 1, 2	0	Not reversed.	0	---	---	Offline	---
					1	Reversed.					
			1	Output signal reverse for CN1 pins 23, 24	0, 1	Same as above	0	---	---	Offline	---
			2	Output signal reverse for CN1 pins 25, 26	0, 1	Same as above	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn513	Not used.	---	(Do not change the setting.)				0321	---	---	---	---
Pn515	Not used.	---	(Do not change the setting.)				8888	---	---	---	---
Pn51B	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn51E	Deviation counter overflow warning level	2	Sets the detection level for the deviation counter overflow warning.				100	%	10 to 100	Online	---
Pn520	Deviation counter overflow level	4	Sets the deviation counter overflow alarm detection level.				262144	Command unit	1 to 1073741823	Online	---
Pn522	Positioning completed range 1	4	Setting range for positioning completed range 1 (INP1)				3	Command unit	0 to 1073741824	Online	---
Pn524	Positioning completed range 2	4	Setting range for positioning completed range 2 (INP2)				3	Command unit	1 to 1073741824	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn526	Deviation counter overflow level at Servo-ON	4	Sets the deviation counter overflow alarm detection level for Servo ON.				262144	Command unit	1 to 1073741823	Online	---
Pn528	Deviation counter overflow warning level at Servo-ON	2	Sets the deviation counter overflow warning detection level for Servo ON.				100	%	10 to 100	Online	---
Pn529	Speed limit level at Servo-ON	2	Sets the speed limit for when the Servo turns ON with position deviation accumulated.				10000	r/min	0 to 10000	Online	---
Pn52A	Not used.	---	(Do not change the setting.)				20	---	---	---	---
Pn52F	Not used.	---	(Do not change the setting.)				FFF	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn530	Program JOG operation related switches	2	0	Program JOG operating pattern	0	(Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536	0	---	---	Online	---
					1	(Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					2	Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					3	(Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536					
					4	(Waiting time Pn535 → Forward movement Pn531 → Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					5	(Waiting time Pn535 → Reverse movement Pn531 → Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn531	Program JOG movement distance	4	Sets the program JOG movement distance.				32768	Command unit	1 to 1073741824	Online	---
Pn533	Program JOG movement speed	2	Sets the program JOG operation movement speed.				500	r/min	1 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn534	Program JOG acceleration/deceleration time	2	Sets the acceleration/deceleration time for program JOG operation.				100	ms	2 to 10000	Online	---
Pn535	Program JOG waiting time	2	Sets the delay time from the program JOG operation start input until operation starts.				100	ms	0 to 10000	Online	---
Pn536	Number of program JOG movements	2	Sets the number of repetitions of the program JOG operations.				1	Times	1 to 1000	Online	---
Pn540	Gain limit	2	Sets the gain limit.				2000	× 0.1 Hz	10 to 2000	Online	---
Pn550	Analog monitor 1 offset voltage	2	Sets the analog monitor 1 offset voltage.				0	× 0.1 V	–10000 to 10000	Online	---
Pn551	Analog monitor 2 offset voltage	2	Sets the analog monitor 2 offset voltage.				0	× 0.1 V	–10000 to 10000	Online	---

Other Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn600	Regeneration resistor capacity	2	Setting for regeneration resistance load ratio monitoring calculations	0	×10 W	0 to (varies by model)	Online	---

Control Function Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	MECHATROLINK communications check mask	0	Detects both communications errors (A.E6□) and synchronization errors (A.E5□).	0	---	---	Online	Always set to 0.
					1	Ignores communications errors (A.E6□).					
					2	Ignores synchronization errors (A.E5□).					
					3	Ignores communications errors (A.E6□) and synchronization errors (A.E5□).					
			1	Warning check mask	0	Detects all parameter setting warnings (A.94□), MECHATROLINK command warnings (A.95□), and communications errors (A.96□).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameter setting warning (A. 94□).					
					2	Ignores command warning (A.95□).					
					3	Ignores A.94□ and A.95□.					
					4	Ignores communications warning (A.96□).					
					5	Ignore A.94□ and A.96□.					
					6	Ignores A.95□ and A.96□.					
					7	Ignores A.94□, A.95□ and A.96□.					
			2	Communications error count at single transmission	0 to F	Detects communications errors (A.E60) if they occur consecutively for the set value plus two times.	0	---	---	Online	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Function selection application 6 (software LS)	2	0	Software limit function	0	Software limit enabled.	3	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Forward/reverse software limits disabled.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using reference	0	No software limit check using reference	0	---	---	Online	Always set to 0.
					1	Software limit check using reference					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn802	Not used.	---	(Do not change the setting.)	0000	---	---	---	---
Pn803	Zero point width	2	Sets the origin position detection range.	10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the software limit for the positive direction.	819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the software limit for the negative direction.	−819,191,808	Command unit	−1,073,741,823 to 1,073,741,823	Online	---
Pn808	Absolute encoder zero point position offset	4	Sets the encoder position and machine coordinate system offsets for when an absolute encoder is used.	0	Command unit	−1,073,741,823 to 1,073,741,823	Offline	---
Pn80A	First step linear acceleration constant	2	Sets the step 1 acceleration for when two-step acceleration is used.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80B	Second step linear acceleration constant	2	Sets the step 2 acceleration for when two-step acceleration is executed, or the one-step acceleration constant for when one-step acceleration is executed.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80C	Acceleration constant switching speed	2	Sets the switching speed for the step 1 and step 2 acceleration when two-step acceleration is executed.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn80D	First step linear deceleration constant	2	Sets the step 1 deceleration for when two-step deceleration is used.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Second step linear deceleration constant	2	Sets the step 2 deceleration for when two-step deceleration is executed, or the one-step deceleration constant for when one-step deceleration is executed.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80F	Deceleration constant switching speed	2	Sets the switching speed for the step 1 and step 2 deceleration when two-step deceleration is executed.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn810	Exponential acceleration/ deceleration bias	2	Sets the bias for when an exponential filter is used for the position command filter.	0	Command units/s	0 to 32767	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn811	Exponential acceleration/ deceleration time constant	2	Sets the time constant for when an exponential filter is used for the position command filter.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn812	Moving average time	2	Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn813	Not used.	---	(Do not change the setting.)	0	---	---	---	---
Pn814	Final travel distance for external positioning	4	Sets the distance from the external signal input position when external positioning is executed.	100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode settings	2	0	Zero point return direction	0	Forward direction	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse direction					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the distance from the latch signal input position to the origin, for when origin search is executed.				100	Command unit	–1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn81B to Pn825	Not used.	---	(Do not change the setting.)				0000	---	---	---	---
Pn900 to Pn910	Not used.	---	(Do not change the setting.)				---	---	---	---	---
Pn920 to Pn95F	Not used.	---	(Do not change the setting.)				----	---	---	---	---

4-5-4 SMARTSTEP Junior Servo Drive (R7D-ZN□-ML2 with Built-in MECHATROLINK-II Communications)

The Servo Parameters listed here can be used when the Position Control Unit is used with a SMARTSTEP Junior Servo Drive with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2).

For further details on each of the parameters, refer to the user's manual for SMARTSTEP Junior Servo Drives.

The timing for Servo Parameters to be enabled are classified into the following two types.

Online (online parameter): Changed settings are enabled immediately after Servo Parameters have been written.

Offline (offline parameters): Changed settings are enabled when the Servo Drive power is cycled or DEVICE SETUP is executed.

The *Details* column indicates whether the following conditions apply to the corresponding parameter.

- Online parameters that can be changed when the axis is stopped (Busy Flag = 0) only.
- Parameters with standard set values when using MECHATROLINK are indicated in the *Details* column as "standard" with the set value. The standard settings are basic settings required when using the Position Control Unit. This manual describes operations assuming standard settings are being used.

For details on fixed and standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

Note Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Drive's user's manual and always check the effect of changing the settings before changing the Servo Parameters.

■ Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switch	2	0	Reverse rotation	0	CCW direction is taken for positive command.	0	---	---	Offline	---
					1	CW direction is taken for positive command.					
					2 to 3	Not used.					
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn00A	Command filter setting	2	Set the command filter constant. When using this parameter, turn ON bit 4 on SW2 on the SMARTSTEP Junior Servo Drive.				0000	---	0000 to 000F	Online	---

■ Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn20E	Electronic gear ratio G1 (numerator)	4	Set the pulse rate for the command pulses and Servomotor travel distance. 0.01≤G1/G2≤100				1	---	1 to 1073741824	Offline	---
Pn210	Electronic gear ratio G2 (denominator)	4					1	---	1 to 1073741824	Offline	---

■ I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selection 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	Offline	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	POT (forward drive prohibited input) signal Input terminal allocation	2	Allocated to CN1, pin 4: Valid for low input	2	---	---	Offline	Standard setting: 2
					8	Always invalid.					
Pn50B	Input signal selection 2	2	0	NOT (reverse drive prohibited input) signal input terminal allocation	3	Allocated to CN1, pin 3: Valid for low input	3	---	---	Offline	Standard setting: 3
					8	Always invalid.					
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn515	Input signal selection 7	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	STOP (emergency stop input)	4	Allocated to CN1, pin 6: Valid for low input	4	---	---	Offline	Standard setting: 4
						Always invalid.					
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn522	Positioning completion width 1	4	Setting range for positioning completed range				10	Command unit	0 to 1,073,741,824	Online	---
Pn524	Positioning completion width 2	4	Setting for proximity range for the Positioning Proximity Flag.				100	Command unit	1 to 1,073,741,824	Online	---

■ **Control Function Parameters**

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	Not used.	0	(Do not change the setting.)	1	---	---	---	---
			1	Warning check mask	0	Detects parameter setting warnings (A.94), command warnings (A.95), and communications errors (A.96).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameters setting warnings (A.94).					
					2	Ignores command warnings (A.95).					
					3	Ignores both parameter setting warnings (A.94) and command warnings (A.95).					
					4	Ignores communications errors (A.96).					
					5	Ignores both parameter setting warnings (A.94) and communications errors (A.96).					
					6	Ignores both command warnings (A.95) and communications errors (A.96).					
					7	Ignores parameter setting warnings (A.94), command warnings (A.95), and communications errors (A.96).					
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Function selection application 6 (software limits)	2	0	Software limit function	0	Software limit enabled.	3	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Software limit disabled in both directions.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
PN803	Zero point width	2	Sets the detection range for the Origin Stop Flag.				10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the forward software limit.				1073741823	Command unit	−1073741823 to 1073741823	Online	---
Pn806	Reverse software limit	4	Sets the reverse software limit.				−1073741823	Command unit	−1073741823 to 1073741823	Online	---
Pn80B	Linear acceleration constant	2	Sets the acceleration speed for the acceleration/deceleration curve used in position control.				100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Linear deceleration constant	2	Sets the deceleration speed for the acceleration/deceleration curve used in position control.				100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn814	Final travel distance for external positioning	4	Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation.				100	Command unit	−1073741823 to 1073741823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode setting	2	0	Zero point return direction	0	Forward	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search.				50	×100 command units/s^2	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search.				5	×100 command units/s^2	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search.				100	Command unit	−1073741823 to 1073741823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn820 to Pn823	Not used.	--	(Do not change the setting.)				0000	---	---	---	---

4-6 Common Operating Memory Area

The Common Operating Memory Area is allocated to outputs used for common PCU operations and settings, such as communications control and transferring common parameters, and inputs used for monitoring the status of these operations.

4-6-1 Common Operating Memory Area Overview

The area allocated as the Common Operating Memory Area is contained in the CPU Bus Unit Area within the CPU Unit's CIO Area. The beginning word of the Common Operating Memory Area is determined by the unit number set for the PCU using the following equation.

Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)

Unit number	Allocated words	Unit number	Allocated words
0	CIO 1500 to CIO 1524	8	CIO 1700 to CIO 1724
1	CIO 1525 to CIO 1549	9	CIO 1725 to CIO 1749

Unit number	Allocated words	Unit number	Allocated words
2	CIO 1550 to CIO 1574	10	CIO 1750 to CIO 1774
3	CIO 1575 to CIO 1599	11	CIO 1775 to CIO 1799
4	CIO 1600 to CIO 1624	12	CIO 1800 to CIO 1824
5	CIO 1625 to CIO 1649	13	CIO 1825 to CIO 1849
6	CIO 1650 to CIO 1674	14	CIO 1850 to CIO 1874
7	CIO 1675 to CIO 1699	15	CIO 1875 to CIO 1899

The Common Operating Memory Area is divided into outputs and inputs. Commands for common PCU operations and settings, such as transferring PCU data (reading, writing, and saving Common Parameters and Axis Parameters) and establishing connections with MECHATROLINK communications are allocated to the output memory area.

Commands are sent to the PCU when the respective bit in the output memory area turns ON or while the respective bit is ON. The common PCU status and MECHATROLINK communications status are input from the PCU to the input memory area.

4-6-2 Common Operating Memory Area Words

The memory allocation of the Common Operating Memory Area is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

Common Operating Output Memory Area

n = CIO 1500 + (unit number × 25)

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	n	00	---	UNIT ERROR RESET	Resets the Unit common error when this bit turns ON.	*12-6 Error Reset*
		01	Data transfer commands	WRITE DATA	Writes data to the PCU from the CPU Unit when this bit turns ON.	*5-2-1 Writing PCU Parameters*
		02		READ DATA	Reads data from the PCU to the CPU Unit when this bit turns ON.	*5-2-2 Reading PCU Parameters*
		03		SAVE DATA	Saves the contents of the PCU's internal memory to its flash memory when this bit turns ON.	*5-2-3 Saving PCU Parameters*
		04 to 15	---	Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---
	n+1	00	Communications control commands	CONNECT	Starts/stops MECHATROLINK communications.	*6-3-1 Establishing Connections*
		01 to 05		Reserved by the system.	These bits are reserved by the system. Do not use.	---
		06	---	WRITE BACKUP DATA	Writes data saved in the PCU's internal flash memory to the Memory Card installed in the CPU Unit when this bit turns ON.	*13-4-2 Memory Card Backup*
		07		READ BACKUP DATA	Reads data from the Memory Card installed in the CPU Unit to the PCU's internal flash memory when this bit turns ON.	
		08 to 14		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---
		15		REJOIN (See note.)	Restarts MECHATROLINK communications.	*6-3-4 Rejoining the Connection*
	n+2	---		Axes to connect (See note.)	Specifies the axes for which to start MECHATROLINK communications.	*6-3-5 Specifying the Axes to Connect*
	n+3 to n+5	---	---	Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	n+6	---	Operating data for data transfer	Number of write words	Specifies the number of words to be written from the CPU Unit to the PCU.	*5-2-1 Writing PCU Parameters*
	n+7	---		Write source area	Specifies the area containing the data to be written from the CPU Unit to the PCU.	
	n+8	---		Write source word	Specifies the beginning word of the data to be written from the CPU Unit to the PCU.	
	n+9	---		Write destination address	Specifies the address in the PCU to which the data is to be written.	
	n+10	---		Number of read words	Specifies the number of words to be read from the PCU to the CPU Unit.	*5-2-2 Reading PCU Parameters*
	n+11	---		Read source address	Specifies the address in the PCU from which the data is to be read.	
	n+12	---		Read destination area	Specifies the area used to store the data read from the PCU.	
	n+13	---		Read destination word	Specifies the word used to store the data read from the PCU.	
	n+14	---	---	Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---

Note The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.

Common Operating Input Memory Area n = CIO 1500 + (unit number × 25)

I/O	Word	Bits	Category	Name	Operation	Details
Input (PCU to CPU Unit)	n+15	00 to 11	PCU common status words	Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---
		12		Unit Error Flag	ON when a Unit common error has occurred.	*12-1 Overview of PCU Errors*
		13		Not used (reserved by the system).	This bit is reserved by the system. Do not use.	---
		14		Data Transferring Flag	ON when data is being transferred between the CPU Unit and PCU, or when data is being saved in the PCU's internal flash memory.	*5-2 Transferring PCU Parameters*
		15		Not used (reserved by the system).	This bit is reserved by the system. Do not use.	---
	n+16	00 to 11		Reserved by the system.	These bits are reserved by the system. Do not use.	---
		12		Memory Card Transfer Error	Indicates that an error occurred when writing/reading backup data to/from the Memory Card.	*13-4-2 Memory Card Backup*
		13		Reserved by the system.	This bit is reserved by the system. Do not use.	---
		14		Unit Busy Flag	ON when PCU is processing command sent to the Common Operating Memory Area. This flag also turns ON during initial processing when PCU power is turned ON or the Unit is restarted.	*12-6 Error Reset*
		15		Connection Status Flag	ON when PCU starts MECHATROLINK communications.	*6-3-2 MECHATROLINK Communications Status*
	n+17 to n+20	---	---	Reserved by the system.	These bits are reserved by the system. Do not use.	---
	n+21	---		Unit error code	Returns the error code when a Unit Common error occurs.	*12-4 Error Codes*

I/O	Word	Bits	Category	Name	Operation	Details
Input (PCU to CPU Unit)	n+22	00	Axis communications status bits	Axis 1 communications status	Bits 00 to 15 correspond to the communications status for axes 1 to 16. The bits will turn ON if the corresponding axes registered in the scan list are communicating normally.	*6-3-2 MECHATROLINK Communications Status*
		01		Axis 2 communications status		
		02		Axis 3 communications status		
		03		Axis 4 communications status		
		04		Axis 5 communications status		
		05		Axis 6 communications status		
		06		Axis 7 communications status		
		07		Axis 8 communications status		
		08		Axis 9 communications status		
		09		Axis 10 communications status		
		10		Axis 11 communications status		
		11		Axis 12 communications status		
		12		Axis 13 communications status		
		13		Axis 14 communications status		
		14		Axis 15 communications status		
		15		Axis 16 communications status		
	n+23 to n+24	---	---	Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---

4-7 Axis Operating Output Memory Areas

The Axis Operating Output Memory Areas contain outputs used to set operation for the Servo Drive and Servomotor axes that are connected using MECHATROLINK communications. These outputs include operating commands, such as direct operation, ORIGIN SEARCH, and JOG, and related position and speed command values.

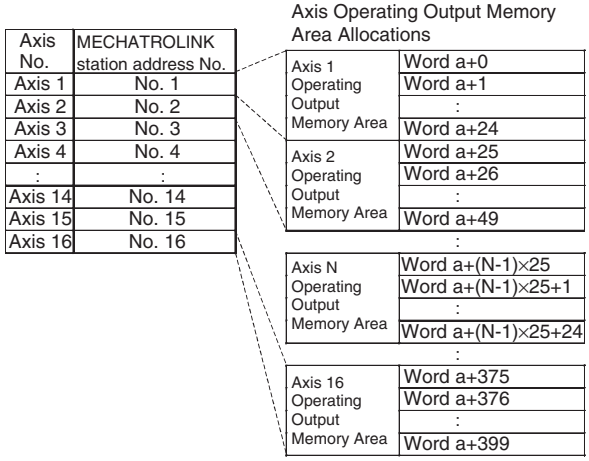
4-7-1 Axis Operating Output Memory Area Overview

The Axis Operating Output Memory Areas are allocated 25 words per axis in the CPU Unit's memory area set in the PCU's Common Parameters (Axis Operating Output Memory Area designation, beginning word of Axis Operating Output Memory Area).

The designated beginning word corresponds to the beginning word of the area for axis 1, and the other areas are allocated words in sequence up to the highest axis number registered in the scan list. For details on area allocations, refer to *6-2-2 Scan List and PCU Area Allocations*.

The beginning words of the Axis Operating Output Memory Areas are determined by the axis number of each axis using the following equation.

Beginning Word of Axis Operating Output Memory Area for Axis N:
a= Beginning word of Axis Operating Output Memory Area specified in Common Parameters + (N−1) × 25 (N = 1 to 16)



a = Beginning word of Axis Operating Output Areas specified in Common Parameters

4-7-2 Axis Operating Output Memory Area Allocations

The memory allocation of the Axis Operating Output Memory Areas is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	a	00	Direct operation commands	LINEAR INTERPOLATION SETTING (See note 1.)	Setting the linear interpolation operation is started when this bit turns ON.	*9-7 Linear Interpolation*
		01		LINEAR INTERPOLATION START (See note 1.)	The linear interpolation operation that has been set is started when this bit turns ON.	
		02		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---
		03		ABSOLUTE MOVEMENT	Starts positioning operation with the designated position treated as an absolute position when this bit turns ON.	*9-4 Using Direct Operation*
		04		RELATIVE MOVEMENT	Starts positioning operation with the designated position treated as a relative position when this bit turns ON.	
		05		INTERRUPT FEEDING	Interrupt feeding begins for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands.	*9-5 Interrupt Feeding*
		06	Origin positioning commands	ORIGIN SEARCH	Executes an origin search when this bit turns ON.	*8-2 Origin Search Operation*
		07		ORIGIN RETURN	Returns position to the origin when this bit turns ON.	*8-4 Origin Return*
		08		PRESENT POSITION PRESET	Forcibly changes the present position to the designated position, and thus establishes an origin relative to the position when this bit turns ON.	*8-3 Present Position Preset*
		09	Commands for special functions	JOG	Jogging is executed while this bit is ON.	*10-2 Jogging*
		10		Direction designation	This bit designates the direction for when jogging is executed.	
		11		Not used (reserved by the system).	This bit is reserved by the system. Do not use.	---
		12		ERROR RESET	Resets (turns OFF) the error status for each axis when this bit turns ON.	*12-6 Error Reset*
		13		DEVIATION COUNTER RESET (See note 4.)	Resets the deviation counter to 0 when this bit turns ON.	*10-10 DEVIATION COUNTER RESET*
		14		Override Enable Bit	This bit enables or disables the override.	*10-3 Override*
		15		DECELERATION STOP	Starts decelerating positioning to a stop when this bit turns ON.	*10-9 Stop Functions*

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	a+1	00	Commands for special functions	SERVO LOCK	Executes SERVO LOCK when this bit turns ON.	*10-1 Servo Lock/ Unlock*
		01		SERVO UNLOCK	Executes SERVO UNLOCK when this bit turns ON.	
		02		SPEED CONTROL	Starts speed control using the speed command value for speed control as the target speed when this bit turns ON.	*10-5 Speed Control*
		03		TORQUE CONTROL	Starts torque control using the torque command value when this bit turns ON.	*10-6 Torque Control*
		04 to 10		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---
		11	Servo Parameter transfer commands	DEVICE SETUP	Starts Servo Drive setup when this bit turns ON.	*5-3-4 Device Setup*
		12		WRITE SERVO PARAMETER	Writes data to the Servo Drive from the CPU Unit when this bit turns ON.	*5-3-1 Writing Servo Parameters*
		13		READ SERVO PARAMETER	Reads data from the Servo Drive to the CPU Unit when this bit turns ON.	*5-3-2 Reading Servo Parameters*
		14		SAVE SERVO PARAMETER	Writes data to the Servo Drive's non-volatile memory at the same time as writing the Servo Parameters when this bit turns ON.	*5-3-3 Saving Servo Parameters*
		15	Special command	EMERGENCY STOP	Executes emergency stop when this bit turns ON.	*10-9 Stop Functions*
	a+2	---	Operating data for position control	Position command value (rightmost word)	Specifies the position for performing present position preset and direct operation.	*9-4 Using Direct Operation* *9-7 Linear Interpolation* *8-3 Present Position Preset*
	a+3	---		Position command value (leftmost word)		
	a+4	---		Speed command value (rightmost word)	Specifies the target speed for performing direct operation, jogging, origin searches, and origin returns.	*8-2 Origin Search Operation* *8-4 Origin Return* *9-4 Using Direct Operation* *9-7 Linear Interpolation* *10-2 Jogging*
	a+5	---		Speed command value (leftmost word)		

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	a+6	---	Speed control data	Speed command value for speed control (rightmost word)	Specifies the target speed for performing speed control.	*10-5 Speed Control*
	a+7	---		Speed command value for speed control (leftmost word)		
	a+8	---	Torque control data	Torque command value (rightmost word)	Specifies the torque for performing torque control.	*10-6 Torque Control*
	a+9	---		Torque command value (leftmost word)		
	a+10	---	Position/ speed/ torque control data	Option command value 1 (rightmost word)	Set the command value of the auxiliary functions for position/ speed/torque control, such as the acceleration/deceleration for linear interpolation, torque feed forward command, the torque limit for speed control, and the speed limit for torque control.	*9-7 Linear Interpolation* *10-5 Speed Control* *10-6 Torque Control*
	a+11	---		Option command value 1 (leftmost word)		
	a+12	---		Option command value 2 (rightmost word)		
	a+13	---		Option command value 2 (leftmost word)		
	a+14	---	Operating data for special function	Override	This bit specifies the override rate.	*10-3 Override*
	a+15	00 to 03	Operating data for expanded monitoring	Monitor 1 type	Specifies the monitor type for monitor 1 in the Axis Operating Input Memory Areas.	*4-8-6 Expanded Monitoring*
		04 to 07		Monitor 2 type	Specifies the monitor type for monitor 2 in the Axis Operating Input Memory Area.	
		08 to 15		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	---

I/O	Word	Bits	Category	Name	Operation	Details
Output (CPU Unit to PCU)	a+16	00 to 02	---	Reserved by the system.	These bits are reserved by the system. Do not use.	---
		03	Acceleration/deceleration curves	Exponential curve designation	Specifies an exponential curve as the acceleration/deceleration curve for executing direct operation, jogging, origin searches, and origin returns.	*8-2 Origin Search Operation* *8-4 Origin Return* *9-4 Using Direct Operation* *10-2 Jogging*
		04		S-curve designation	Specifies an S-curve (movement average) as the acceleration/deceleration curve for executing direct operation, jogging, origin searches, and origin returns.	
		05 to 13	---	Reserved by the system.	These bits are reserved by the system. Do not use.	---
		14	Torque limit	Forward rotation current limit designation	Specifies the torque limit in the forward direction for axis operation.	*10-4 Torque Limits*
		15		Reverse rotation current limit designation	Specifies the torque limit in the reverse direction for axis operation.	
	a+17	---	Operating data for transferring Servo Parameters	Servo Parameter No.	Specifies the parameter number for the Servo Parameters to be written from or read to the CPU Unit.	*5-3 Transferring Servo Parameters*
	a+18	---		Parameter size	Specifies the parameter size for the Servo Parameters to be written from or read to the CPU Unit.	
	a+19	---		Write data (rightmost word)	Specifies the data to be written to the Servo Drive from the CPU Unit.	*5-3-1 Writing Servo Parameters* *5-3-3 Saving Servo Parameters*
	a+20	---		Write data (leftmost word)		
	a+21	00 to 03	Linear interpolation data	Interpolation axis designation for axes 1 to 4 (See note 2.)	Specifies the axes for linear interpolation for combinations of axes 1 to 4.	*9-7 Linear Interpolation*
		04 to 07		Interpolation axis designation for axes 5 to 8 (See note 3.)	Specifies the axes for linear interpolation for combinations of axes 5 to 8.	
		08 to 15		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	
	a+22	00 to 03		Interpolation position designation for axes 1 to 4 (See note 2.)	Specify absolute or relative positioning for the axes for linear interpolation.	
		04 to 07		Interpolation position designation for axes 5 to 8 (See note 3.)		
		08 to 15		Not used (reserved by the system).	These bits are reserved by the system. Do not use.	
	a+23	---		Interpolation speed command value (rightmost word) (See note 1.)	Specifies the interpolation speed for linear interpolation.	
	a+24	---		Interpolation speed command value (leftmost word) (See note 1.)		

Note

(1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.

4-7-3 Axis Operating Output Memory Area Priority

The Position Control Unit performs exclusive control for the command executed for the axis operating output bits. Depending on the status of the Position Control Unit (i.e., the Servo locked/unlocked status, Busy Flag status, and ON/OFF status of axis operating output bits), the command is disabled or detected as an error.

The operations that are performed when an attempt is made to execute more than one function are described depending on the operating status.

When Position Control Unit Is Not Executing a Function (When Busy Flag = 0)

The operation that is performed for each command when the Position Control Unit is not executing a function (including when the Busy Flag is reset after completing or canceling operation) is shown below depending on the Servo locked/unlocked status and the ON/OFF status of axis operating output bits.

(Refer to *12-1 Overview of PCU Errors* for information on executing functions when an error exists.)

Servo Unlocked

	Function to be executed (See note.)														
Executing function	**SERVO UNLOCK**	**DEVIATION COUNTER RESET**	**EMERGENCY STOP**	**DECELERATION STOP**	**JOG**	**ORIGIN SEARCH**	**ORIGIN RETURN**	**ABSOLUTE MOVEMENT**	**RELATIVE MOVEMENT**	**INTERRUPT FEEDING**	**SPEED CONTROL**	**TORQUE CONTROL**	**PRESET POSITION PRESET**	**DEVICE SETUP**	**SERVO LOCK**
SERVO UNLOCK Bit ON	---	---	---	---	---	---	---	---	---	---	---	---	❍	❍	---
DEVIATION COUNTER RESET Bit ON	❍	---	---	---	---	---	---	---	---	---	---	---	❍	❍	---
EMERGENCY STOP Bit ON	❍	---	---	---	---	---	---	---	---	---	---	---	❍	❍	---
DECELERATION STOP Bit ON	❍	---	---	---	---	---	---	---	---	---	---	---	❍	❍	---
Other than above status	❍	---	---	---	×	×	×	×	×	×	×		❍	❍	❍

❍: Execution possible

×: A servo unlock error (axis error code: 3040) will occur and the function will not be executed.

---: Execution not possible (ignored)

Note: The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

Servo Locked

	Function to be executed (See note.)														
Executing function	**SERVO UNLOCK**	**DEVIATION COUNTER RESET**	**EMERGENCY STOP**	**DECELERATION STOP**	**JOG**	**ORIGIN SEARCH**	**ORIGIN RETURN**	**ABSOLUTE MOVEMENT**	**RELATIVE MOVEMENT**	**INTERRUPT FEEDING**	**SPEED CONTROL**	**TORQUE CONTROL**	**PRESET POSITION PRESET**	**DEVICE SETUP**	**SERVO LOCK**
DEVIATION COUNTER RESET Bit ON	❍	---	---	---	---	---	---	---	---	---	---	---	❍	×	---
EMERGENCY STOP Bit ON	❍	❍	---	---	---	---	---	---	---	---	---	---	❍	×	---
DECELERATION STOP Bit ON	❍	❍	❍	---	---	---	---	---	---	---	---	---	❍	×	---
Other than above status	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	×	---

❍: Execution possible

×: A multistart error (axis error code: 3050) will occur and the function will not be executed.

---: Execution not possible (ignored)

Note: The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

When Position Control Unit Is Executing a Function (When Busy Flag = 1)

The operation that is performed for each command when the Position Control Unit is already executing a function is shown below depending on the Servo locked/unlocked status and the ON/OFF status of axis operating output bits.

	Function to be executed (See note.)														
Executing function	**SERVO UNLOCK**	**DEVIATION COUNTER RESET**	**EMERGENCY STOP**	**DECELERATION STOP**	**JOG**	**ORIGIN SEARCH**	**ORIGIN RETURN**	**ABSOLUTE MOVEMENT**	**RELATIVE MOVEMENT**	**INTERRUPT FEEDING**	**SPEED CONTROL**	**TORQUE CONTROL**	**PRESET POSITION PRESET**	**DEVICE SETUP**	**SERVO LOCK**
SERVO UNLOCK	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DEVIATION COUNTER RESET	❍	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EMERGENCY STOP	❍	❍	---	---	---	---	---	---	---	---	---	---	---	---	---

	Function to be executed (See note.)														
Executing function	**SERVO UNLOCK**	**DEVIATION COUNTER RESET**	**EMERGENCY STOP**	**DECELERATION STOP**	**JOG**	**ORIGIN SEARCH**	**ORIGIN RETURN**	**ABSOLUTE MOVEMENT**	**RELATIVE MOVEMENT**	**INTERRUPT FEEDING**	**SPEED CONTROL**	**TORQUE CONTROL**	**PRESENT POSITION PRESET**	**DEVICE SETUP**	**SERVO LOCK**
DECELERATION STOP	❍	❍	❍	---	---	---	---	---	---	---	---	---	---	---	---
JOG	❍	❍	❍	❍	---	×	×	×	×	×	×	×	×	×	---
ORIGIN SEARCH	❍	❍	❍	❍	×	×	×	×	×	×	×	×	×	×	---
ORIGIN RETURN	❍	❍	❍	❍	×	×	×	×	×	×	×	×	×	×	---
POSITION CONTROL (ABSOLUTE MOVEMENT)	❍	❍	❍	❍	×	×	×	❍	❍	×	❍	❍	×	×	---
POSITION CONTROL (RELATIVE MOVEMENT)	❍	❍	❍	❍	×	×	×	❍	❍	×	❍	❍	×	×	---
INTERRUPT FEEDING	❍	❍	❍	❍	×	×	×	×	×	×	❍	❍	×	×	---
SPEED CONTROL	❍	---	❍	❍	×	×	×	❍	❍	❍	❍	❍	×	×	---
TORQUE CONTROL	❍	---	❍	❍	×	×	×	❍	❍	❍	❍	❍	×	×	---
PRESENT POSITION PRESET	❍	×	❍	❍	×	×	×	×	×	×	×	×	×	×	×
DEVICE SETUP	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
SERVO LOCK	❍	---	---	---	×	×	×	×	×	×	×	×	×	×	×

❍: Execution possible

×: A multistart error (axis error code: 3050) will occur and the function will not be executed.

---: Execution not possible (ignored)

Note: The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

Executing Multiple Functions Simultaneously

The following table shows the PCU operations when multiple functions are executed at the same time for the same axis during a servo lock (including executing other functions while the Receiving Command Flag is ON.

Function	Operation for simultaneous execution
SERVO UNLOCK	Takes priority over any other function executed at the same time. All other operations are disabled while the SERVO UNLOCK Bit is ON.
DEVIATION COUNTER RESET	Takes priority over any other function executed at the same time except for SERVO UNLOCK. The following functions will not be started while the DEVIATION COUNTER RESET Bit is ON.
EMERGENCY STOP	Executed before any other function executed at the same time, except SERVO UNLOCK or DEVIATION COUNTER RESET. All other operation functions are disabled while the EMERGENCY STOP Bit is ON.

Function	Operation for simultaneous execution
DECELERATION STOP	Executed before any other function executed at the same time, except SERVO UNLOCK, DEVIATION COUNTER RESET, and EMERGENCY STOP. All other operation functions are disabled while the DECELERATION STOP Bit is ON.
ABSOLUTE/RELATIVE MOVEMENT (with INTERRUPT FEEDING) ORIGIN SEARCH ORIGIN RETURN PRESENT POSITION PRESET JOG SPEED CONTROL TORQUE CONTROL DEVICE SETUP SERVO LOCK	A Multistart Error (error code: 3050) will occur if these commands are executed at the same time.

4-8 Axis Operating Input Memory Areas

The Axis Operating Input Memory Areas are allocated inputs for monitoring the status of axis operations of the Servo Drive and Servomotor axes that are connected using MECHATROLINK communications. These include present position and axis operating status.

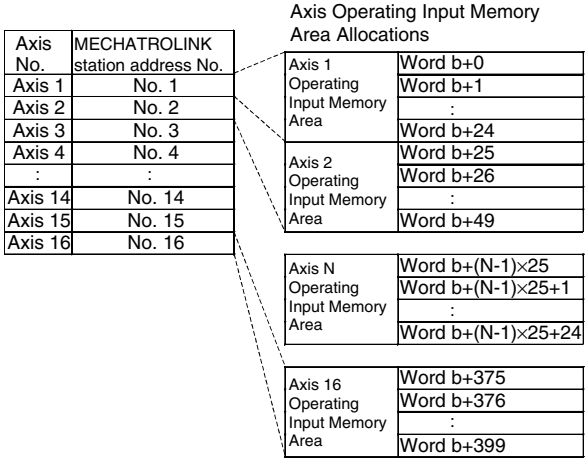
4-8-1 Axis Operating Input Memory Area Overview

The Axis Operating Input Memory Areas are allocated 25 words for each axis in the CPU Unit's memory area set in PCU's Common Parameters (Axis Operating Input Memory Area designation and beginning word of Axis Operating Input Memory Area).

The designated beginning word corresponds to the beginning word of the area for axis 1, and the other areas are allocated words in sequence up to the highest axis number registered in the scan list. For details on area allocations, refer to *6-2-2 Scan List and PCU Area Allocations*.

The beginning words of the Axis Operating Input Memory Areas are determined by the axis number of each axis using the following equation.

Beginning Word of Axis Operating Input Memory Area for Axis N:
b = Beginning word of Axis Operating Input Memory Area specified in Common Parameters + (N–1) × 25 (N = 1 to 16)



b: Beginning word of the Axis Operating Memory Areas specified in the Common Parameters.

4-8-2 Axis Operating Input Memory Area Allocations

The memory allocation of the Axis Operating Input Memory Areas is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	Word	Bits	Category	Name	Function	Details
Input (PCU to CPU Unit)	b	00	Axis Control Status Flags	Receiving Command Flag	ON when the PCU is in the process of receiving an operating command. 1: Receiving command If another operating command with the same priority level is started while this flag is ON, a Multistart Error (axis error code: 3050) will occur. (Refer to *4-7-3 Axis Operating Output Memory Area Priority*.) The Receiving Command Flag remains ON (1) for at least one cycle time, and turns OFF (0) when the command reception processing is completed.	*4-8-3 Axis Control Status Flags* *9-4 Using Direct Operation* *10-5 Speed Control* *10-6 Torque Control*
		01 to 04		Not used (reserved by the system).	Always 0.	---
		05		PCU Positioning Completed Flag	ON when a PCU operation executed in response to a positioning command is completed and the axis position is within the positioning completion range set for the target position. 1: Any of the following operations are completed: Direct operation (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN The flag turns OFF (0) when the power is turned ON, a connection is established, or when another axis operation is started. This flag remains OFF if EMERGENCY STOP or DECELERATION STOP are executed while the axis is operating.	*4-8-3 Axis Control Status Flags* *8-2 Origin Search Operation* *8-4 Origin Return* *9-4 Using Direct Operation*

I/O	Word	Bits	Category	Name	Function	Details
Input (PCU to CPU Unit)	b	06	Axis Control Status Flags	No Origin Flag	ON when the origin is not established.	*4-8-3 Axis Control Status Flags* *8-2 Origin Search Operation* *8-3 Present Position Preset*
		07		Origin Stop Flag	ON when the present position of the axis is stopped within the origin range set in *Zero Point Width*.	*4-8-3 Axis Control Status Flags* *8-2 Origin Search Operation*
		08 to 10		Not used (reserved by the system).	Always 0.	---
		11		Warning Flag	ON when an axis warning has occurred.	*12-1 Overview of PCU Errors*
		12		Error Flag	ON when an axis error has occurred.	
		13		Busy Flag	ON during axis operation or processing.	*4-8-3 Axis Control Status Flags*
		14		Servo Parameter Transferring Flag	ON during transfer of Servo Parameters.	*5-3 Transferring Servo Parameters*
		15		Stop Execution Flag	ON when axis operation is stopped in response to EMERGENCY STOP or DECELERATION STOP.	*4-8-3 Axis Control Status Flags* *10-9 Stop Functions*

I/O	Word	Bits	Category	Name	Function	Details
Input (PCU to CPU Unit)	b+1	00 to 02	Servo Status Flags	Reserved by the system.	Used by the PCU system.	---
		03		Servo ON (SVON) Flag	ON while Servo Drive is in Servo lock status.	*4-8-4 Servo Status Flags* *10-1 Servo Lock/ Unlock*
		04		Main Power ON Flag (PON)	Indicates the status of the main circuit power supply to the Servo Drive.	*4-8-4 Servo Status Flags*
		05 and 06		Reserved by the system.	Used by the PCU system.	---
		07		Positioning Completed (PSET) Flag/ Speed Conformity (V-CMP) Flag	The function of these flags depends on whether position control or speed control is being used. For details, refer to the relevant sections.	*4-8-4 Servo Status Flags* *10-5-2 Starting Speed Control*
		08		Distribution Completed (DEN) Flag/ Zero Speed (ZSPD) Flag		
		09		Torque Limit (T_LIM) Status Flag	ON when the torque limit function is enabled and activated.	*4-8-4 Servo Status Flags* *10-4-3 Torque Limits Set by Operating Commands*
		10		Reserved by the system.	Used by the PCU system.	---
		11		Positioning Proximity (NEAR) Flag/ Speed Limit (V_LIM) Status Flag	The function of these flags changes according to whether position control or torque control is being used. For details, refer to the relevant sections.	*4-8-4 Servo Status Flags* *10-6-2 Starting Torque Control*
		12		Forward Software Limit Flag (P_SOT)	Indicates whether the present position is within the forward software limit range.	*4-8-4 Servo Status Flags* *10-8 Software Limits*
		13		Reverse Software Limit Flag (N_SOT)	Indicates whether the present position is within the reverse software limit range.	
		14 to 15		Reserved by the system.	Used by the PCU system.	---
	b+2	---	---	Reserved by the system.	Used by the PCU system.	---

I/O	Word	Bits	Category	Name	Function	Details
Input (PCU to CPU Unit)	b+3	00	External I/O status	Forward rotation limit input	Returns the status of I/O signals for each axis. 1: Signal valid 0: Signal invalid The external I/O status shows the enabled/disabled status of signals used for PCU control. This status is different from the electrical ON/OFF status of the I/O signals.	*4-8-5 External I/O Status Bits*
		01		Reverse rotation limit input		
		02		Origin proximity input		
		03		Encoder Phase A input		
		04		Encoder Phase B input		
		05		Encoder Phase Z input		
		06		External latch signal 1 input		
		07		External latch signal 2 input		
		08		External latch signal 3 input		
		09		Brake output		
		10		Emergency stop input		
		11 to 15		Reserved by the system.		
	b+4	---	Errors	Axis error code	Returns the error code for the axis error.	*12-4 Error Codes*
	b+5	00 to 03	Expanded monitoring	Monitor 1 type	Indicates the monitor type for the present monitor 1 (b+10, b+11).	*4-8-6 Expanded Monitoring*
		04 to 07		Monitor 2 type	Indicates the monitor type for the present monitor 2 (b+12, b+13).	
		08 to 15		Not used (reserved by the system).	Always 0.	
	b+6	---	Present position	Feedback present position (rightmost word)	Returns the feedback present position.	*7-3 Coordinate System and Present Position*
	b+7	---		Feedback present position (leftmost word)		
	b+8	---		Command present position (rightmost word)	Returns the command present position.	
	b+9	---		Command present position (leftmost word)		

I/O	Word	Bits	Category	Name	Function	Details
Input (PCU to CPU Unit)	b+10	---	Expanded monitoring	Monitor 1 (rightmost word)	Returns the value for the monitor specified as monitor 1 type in the Axis Operating Output Memory Areas.	*4-8-6 Expanded Monitoring*
	b+11	---		Monitor 1 (leftmost word)		
	b+12	---		Monitor 2 (rightmost word)	Returns the value for the monitor specified as monitor 2 type in the Axis Operating Output Memory Areas.	
	b+13	---		Monitor 2 (leftmost word)		
	b+14	---	Servo Parameter data	Read data (rightmost word)	Returns the data read to the CPU Unit from the Servo Drive.	*5-3-2 Reading Servo Parameters*
	b+15	---		Read data (leftmost word)		
	b+16 to b+23	---	---	Not used (reserved by the system).	Always 0.	---
	b+24	00	Linear interpolation status	Linear interpolation setting completed (See note.)	Indicates when setting the Position Control Unit has been completed for linear interpolation. 1: Linear interpolation setting completed.	*9-7 Linear Interpolation*
		01 to 12		Not used (reserved by the system).	Always 0.	
		13		Linear interpolation executing (See note.)	Indicates when linear interpolation is being performed.	
		14 and 15		Not used (reserved by the system).	Always 0.	

Note Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

4-8-3 Axis Control Status Flags

The Axis Control Status Flags in word b indicate the control status for each axis connected to the PCU. Use these flags to interface with the CPU Unit when using PCU functions.

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
PCU Positioning Completed Flag		05	0 → 1: Positioning completed.
No Origin Flag		06	0: Origin established. 1: Origin not established.
Origin Stop Flag		07	0: Outside origin range. 1: Within origin range.
Warning Flag		11	0: No warning. 1: Warning has occurred.
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).
Servo Parameter Transferring Flag		14	0: Powerup, transfer completed, or transfer failed. 1: Servo Parameter transferring.
Stop Execution Flag		15	0 → 1: Stop operation completed.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The flags that are particularly for controlling axis operation are described next. For details on timing charts for each flag operation, refer to the relevant section.

For details on the Error Flag and Warning Flag, refer to *SECTION 12 Troubleshooting*. For details on the Servo Parameters Transferring Flag, refer to *5-3 Transferring Servo Parameters*.

Receiving Command Flag

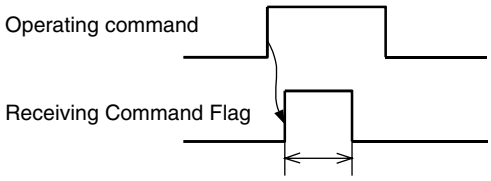
Word b

Bit 00

Function This flag turns ON when the PCU is in the process of receiving any of the following operating commands.

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG (JOG Bit ON), DECELERATION STOP, EMERGENCY STOP, SERVO LOCK, SERVO UNLOCK, SPEED CONTROL, TORQUE CONTROL, DEVICE SETUP, ERROR RESET, or DEVIATION COUNTER RESET.

The PCU turns ON the Receiving Command Flag when an operating command is received from the CPU Unit, and the flag remains ON for at least CPU Unit cycle time. The flag turns OFF when the command reception processing is completed.
If another operating command with the same priority level is started while this flag is ON, a Multistart Error (axis error code: 3050) will occur. (Refer to *4-7-3 Axis Operating Output Memory Area Priority*.)



The Receiving Command Flag remains ON for either the length of one CPU Unit cycle time or for the time required by the PCU to process command reception, whichever is longer.

The Receiving Command Flag status does not change when changing the target speed during position control/speed control, changing the torque command value during torque control, switching override enable/disable, changing the override value, or transferring Servo Parameters.
The Receiving Command Flag is used mainly to determine ON/OFF timing of the operating command bits when sending more than one operating command at the same time during axis operation (i.e., while the Busy Flag is ON), such as changing the target position while using direct operation.

PCU Positioning Completed Flag

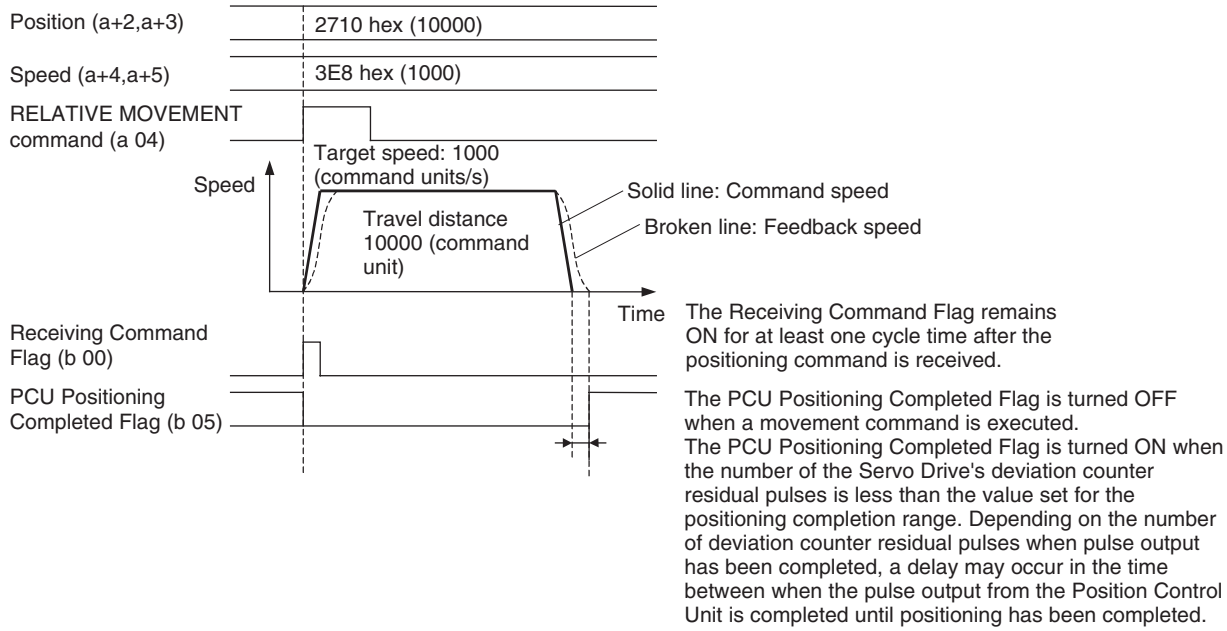
Word b

Bit 05

Function This flag turns ON when a PCU operation is completed normally in response to any of the following positioning commands and the feedback present position of the axis has reached a position within the range of the Servo Parameter *Positioning Completion Range 1* (Pn060 for R88D-GN□, Pn500 for R88D-WT□, and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior) specified for the target position (command position). (The position deviation must be within the range of *Positioning Completion Range 1*.)

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, or ORIGIN RETURN.

Example: Executing RELATIVE MOVEMENT COMMAND.


Position (a+2,a+3)
2710 hex (10000)
Speed (a+4,a+5)
3E8 hex (1000)
RELATIVE MOVEMENT command (a 04)
Target speed: 1000 (command units/s)
Speed
Solid line: Command speed
Travel distance 10000 (command unit)
Broken line: Feedback speed
Time
Receiving Command Flag (b 00)
The Receiving Command Flag remains ON for at least one cycle time after the positioning command is received.
PCU Positioning Completed Flag (b 05)
The PCU Positioning Completed Flag is turned OFF when a movement command is executed.
The PCU Positioning Completed Flag is turned ON when the number of the Servo Drive's deviation counter residual pulses is less than the value set for the positioning completion range. Depending on the number of deviation counter residual pulses when pulse output has been completed, a delay may occur in the time between when the pulse output from the Position Control Unit is completed until positioning has been completed.

The PCU Positioning Completed Flag will not turn ON when axis operation stops under the following conditions.

- Stops due to an error during positioning.
- Stops due to DECELERATION STOP or EMERGENCY STOP sent during positioning.
- Jogging (JOG) stops.

The PCU Positioning Completed Flag will also not turn ON when axis operation stops during positioning due to DECELERATION STOP or EMERGENCY STOP, even if the position is within the *Positioning Completion Range 1* specified for the original target position.

The PCU Positioning Completed Flag will turn OFF when the power is turned ON, a connection is released, another axis operation is started successfully (including jogging, speed control, and torque control), or Servo Unlock is executed.

Note On machines for which position deviation occurs between the feedback position and target position (command position) when the axis is stopped, such as pushing a load or using a vertical axis, the PCU Positioning Completed Flag will not turn ON if the set value for the *Positioning Completion Range 1* is too small. Adjust the set value for the *Positioning Completion Range 1* to suit the operating conditions for the machine.

No Origin Flag

Word b

Bit 06

Function This flag turns ON when the origin is not established. Except when using Servomotors with absolute encoders, the PCU's No Origin Flag turns ON immediately after a connection is established, at which time the origin is not established. (The No Origin Flag turns OFF, however, immediately after the PCU power is turned ON or the Unit is restarted, and the flag remains OFF until the first CONNECT is executed.) The origin for each axis is determined by either of the following origin positioning operations, after which the No Origin Flag turns OFF.

ORIGIN SEARCH, PRESENT POSITION PRESET

When using Servomotors with absolute encoders, the origin is established by reading the absolute value data when establishing a connection or executing SERVO LOCK. The established origin is held even if SERVO UNLOCK is executed, and will not be set to no origin status. No origin status (No Origin Flag ON) occurs under the following conditions.

- When DEVICE SETUP is executed (during Servo unlock status)
- When a connection is released (See note.)

Note When a connection is released (including a disconnection due to error), the status for each axis becomes undefined (non-execution), except for the Error Flag and axis error code. The No Origin Flag turns ON while in no origin (origin not established) status.

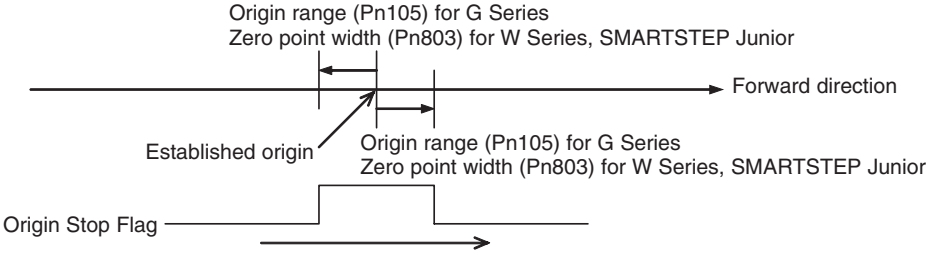
Origin Stop Flag

Word b

Bit 07

Function This flag turns ON when the origin has been established and the present position of each axis is within the *Origin Range* set in Servo Parameter Pn105 for the R88D-G□ or *Zero Point Width* set in Servo Parameter Pn803 for the R88D-WT□, the R88D-WN□-ML2, or a SMARTSTEP Junior Servo Drive.

This flag turns ON for the interval in which the present position is within the *Origin Range* or *Zero Point Width* when it passes the *Origin Range* or *Zero Point Width* during axis operation.


Origin range (Pn105) for G Series
Zero point width (Pn803) for W Series, SMARTSTEP Junior
Forward direction
Established origin
Origin range (Pn105) for G Series
Zero point width (Pn803) for W Series, SMARTSTEP Junior
Origin Stop Flag

The Origin Stop Flag turns ON while the present position is within the range of ±Pn105 for G-series Servo Drives or ±Pn803 for W-series and SMARTSTEP Junior Servo Drives from the established origin when traveling forward.

Busy Flag

Word b

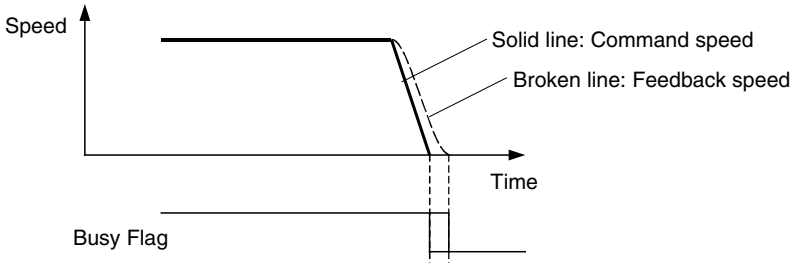
Bit 13

Function This flag turns ON to indicate that the Position Control Unit is executing one of the following operating commands. The flag will turn ON when the operation command is started and remain ON for at least one cycle time of the CPU Unit. For commands associated with axis operations, the Busy Flag remains ON during the axis operation.

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG (JOG ON, JOG OFF), DECELERATION STOP, EMERGENCY STOP, SERVO LOCK, SERVO UNLOCK, SPEED CONTROL, TORQUE CONTROL, DEVICE SETUP, ERROR RESET, or DEVIATION COUNTER RESET.

For operating commands associated with axis operations, the Busy Flag status when the axis operation is completed (axis stops) depends on the operating command, as follows:

- ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, or ORIGIN RETURN:
  The Busy Flag turns OFF when the axis feedback position reaches the Servo Parameter *Positioning Completion Range 1* (Pn060 for R88D-GN□, Pn500 for R88D-WT□, and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior) set for the target stop position. (The Busy Flag turns OFF at the same time as the PCU Positioning Completed Flag turns ON.)
- Jogging Stopped (JOG Bit OFF), DECELERATION STOP, EMERGENCY STOP (Including Error Stop), or DEVIATION COUNTER RESET:
  The Busy Flag turns OFF regardless of the axis feedback position when the command position reaches the target (stop) position (i.e., when sending the command to the Servo Drive is completed).



The Busy Flag turns OFF at completion of sending the command (i.e., when the command present position stops changing) when the axis stops due to jogging stop (JOG Bit OFF), DECELERATION STOP, or EMERGENCY STOP (including error stop).

When positioning for ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, or ORIGIN RETURN stops, the Busy Flag will not turn OFF until the feedback present position is within the *Positioning Completion Range* for the command position.

Stop Execution Flag

Word	b
Bit	15
Function	This flag turns ON in response to a DECELERATION STOP or EMERGENCY STOP execution regardless of the axis operation status. If DECELERATION STOP or EMERGENCY STOP is executed during axis operation, the Stop Execution Flag turns ON when the command position reaches the target (stop) position (i.e., when sending the command to the Servo Drive is completed) regardless of the axis feedback position. This flag then turns OFF when the power is turned ON, a connection is released, or when another axis operation is started.
Details	Refer to *10-9 Stop Functions*.

4-8-4 Servo Status Flags

The Servo Status Flags (word b+1) are flags that monitor the control status of the Servo Drive. This enables monitoring of the Servo Drive control status (position, speed, torque control loop).

Name	Word	Bits	Contents
Servo ON Flag	b+1	03	0: Servo unlocked. 1: Servo locked.
Main Power ON Flag		04	0: Main circuit power supply OFF. 1: Main circuit power supply ON.
Positioning Completed Flag/Speed Conformity Flag		07	During position control: Positioning Completed Flag 0: Sending position control command to Servo Drive or the position is outside *Positioning Completion Range 1*. 1: Sending position control command to Servo Drives completed and the position is within *Positioning Completion Range 1*. During speed control: Speed Conformity Flag 0: Speed does not match the speed command value for speed control. 1: Speed matches the speed command value for speed control.
Distribution Completed Flag/Zero Speed Flag		08	During position control: Distribution Completed Flag 0: Sending position control command to Servo Drive. 1: Sending position control command to Servo Drive completed. During speed control: Zero Speed Flag 0: Not zero speed. 1: Detecting zero speed.
Torque limit		09	0: Torque limit function disabled. 1: Torque limit function enabled.
Positioning Proximity Flag/Speed Limit Status Flag		11	During position control: Positioning Proximity Flag 0: Outside Positioning *Completion Range 2* 1: Within Positioning *Completion Range 2* During torque control: Speed Limit Status Flag 0: Speed limit function disabled. 1: Speed limit function enabled.
Forward Software Limit Flag		12	0: Within forward software limit. 1: Forward software limit exceeded.
Reverse Software Limit Flag		13	0: Within reverse software limit. 1: Reverse software limit exceeded.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The functions of the bits shown in this table are applicable when the Position Control Unit is connected to a G-series Servo Drive, a W-series Servo Drive combined with a JUSP-NS115 MECHATROLINK-II Application Module, a W-series Servo Drive with Built-in MECHATROLINK-II communications, or to a SMARTSTEP Junior Servo Drive. The functions of Servo Status Flags 07, 08, and 11 depend on whether position control, speed control, or torque control is being used. (The SMARTSTEP Junior Servo Drive supports only position control.)

Note The Servo Status Flags are used to monitor the control status of the Servo Drive. The Servo Status Flags may not reflect the Servo status for short-term changes in Servo Drive status, depending on the PLC cycle time and MECHATROLINK communications cycle.

Servo ON Flag

Word b+1

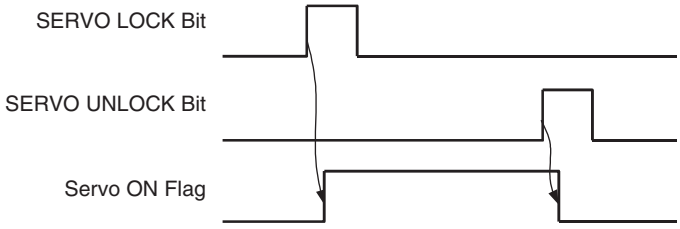
Bit 03

Function ON while Servo Drive is in Servo lock status during position control or in Servo ON status (Servomotor carrying current) during speed or torque control.

0: Servo unlocked (Servo OFF)

1: Servo locked (Servo ON)

This flag turns ON when the SERVO LOCK Bit (a+1, bit 00) in the Axis Operating Output Memory Area turns ON, and turns OFF when the SERVO UNLOCK Bit (a+1, bit 01) turns ON or an error that sets the Servo in free run state occurs.



Details Refer to *10-1 Servo Lock/Unlock*.

Main Power ON Flag

Word b+1

Bit 04

Function Indicates the status of the main circuit power supply to the Servo Drive.

0: Main circuit power supply OFF

1: Main circuit power supply ON

Positioning Completed Flag (during Position Control) Speed Conformity Flag (during Speed Control)

Word b+1

Bit 07

Function The function of these flags depends on whether position control or speed control is being used.

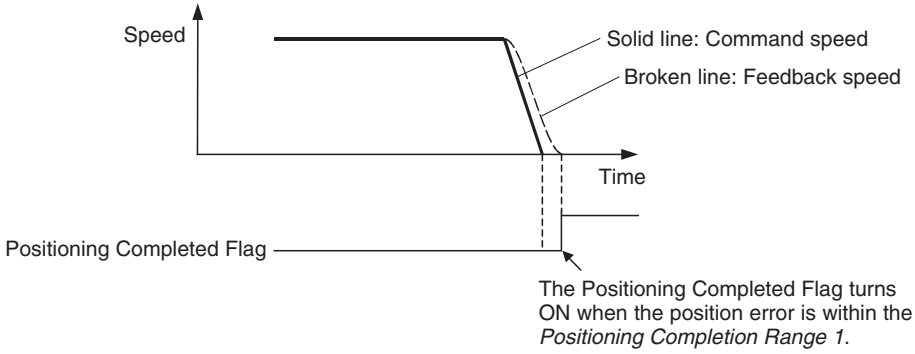
During Position Control: Positioning Completed Flag

This flag turns ON when the command position reaches the target (stop) position (Sending position control command to Servo Drive completed), and the feedback position is within the range set for the target (stop) position Servo Parameter *Positioning Completion Range 1* (Pn060 for R88D-GN□, Pn500 for R88D-WT□, and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior).

0: Sending position control command to Servo Drive or the position is outside *Positioning Completion Range 1*.

1: Sending position control command to Servo Drive completed and the position is within *Positioning Completion Range 1*.

The Positioning Completed Flag in the Servo Status Flags is different to the PCU Positioning Completed Flag in the Axis Control Status Flags (word b, bit 05). In addition to when positioning stops, this flag turns ON when the number of pulses remaining in the Servo Drive's deviation counter are within the *Positioning Completion Range 1*, even for jogging stops, deceleration stops, emergency stops, and error stops.

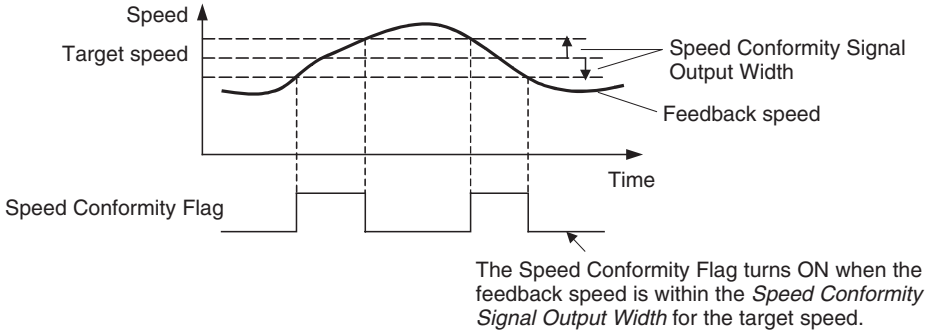

Speed
Solid line: Command speed
Broken line: Feedback speed
Time
Positioning Completed Flag
The Positioning Completed Flag turns ON when the position error is within the *Positioning Completion Range 1*.

During Speed Control: Speed Conformity Flag (G-series Servo Drives and W-series Servo Drives Only)

This flag turns ON when the feedback speed during speed control matches the target speed (speed command value for speed control), i.e., the speed is within the range of the Servo Parameter *Speed Conformity Signal Output Width* (Pn061 for R88D-GN□ and Pn503 for R88D-W□).

0: Speed does not match the speed command value for speed control.

1: Speed does match the speed command value for speed control.


Speed
Target speed
Speed Conformity Signal Output Width
Feedback speed
Time
Speed Conformity Flag
The Speed Conformity Flag turns ON when the feedback speed is within the *Speed Conformity Signal Output Width* for the target speed.

Details Refer to *10-5-2 Starting Speed Control*.

Distribution Completed Flag (during Position Control)
Zero Speed Flag (during Speed Control)

Word b+1

Bit 08

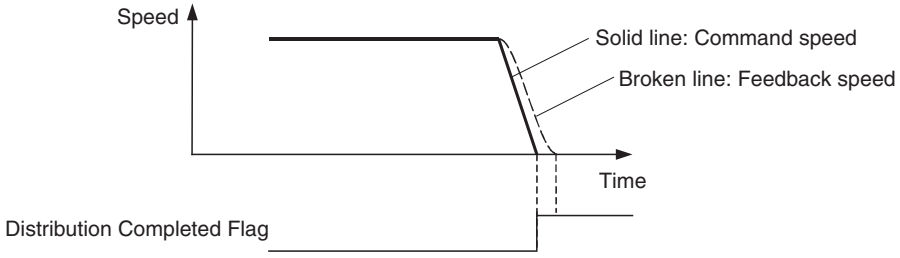
Function The function of these flags depends on whether position control or speed control is being used.

During Position Control: Distribution Completed Flag

This flag turns ON when the command position reaches the target (stop) position (When sending the position control command to Servo Drive is completed).

0: Sending the position control command to Servo Drive.

1: Sending the position control command to Servo Drive completed.

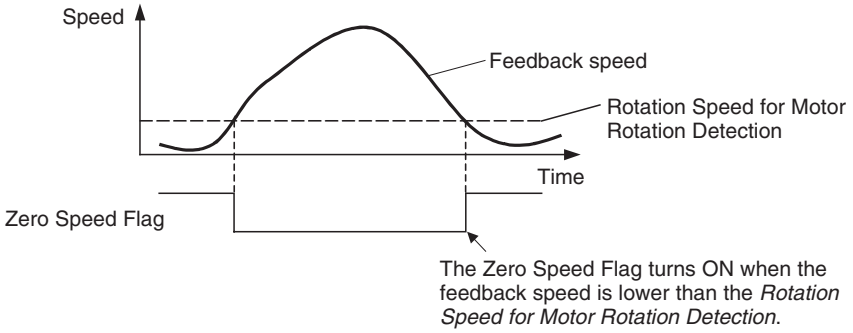


During Speed Control: Zero Speed Flag (G-series Servo Drives and W-series Servo Drives Only)

This flag turns ON when the feedback speed during speed control drops below the Servo Parameter *Rotation Speed for Motor Rotation Detection* (Pn062 for R88D-GN□ and Pn502 for R88D-W□).

0: Not at zero speed

1: Detecting zero speed


Speed
Feedback speed
Rotation Speed for Motor Rotation Detection
Time
Zero Speed Flag
The Zero Speed Flag turns ON when the feedback speed is lower than the *Rotation Speed for Motor Rotation Detection*.

Details Refer to *10-5-2 Starting Speed Control*.

Torque Limit Status Flag

Word b+1

Bit 09

Function This flag turns ON when the Servomotor's output torque is limited by the torque limit.

For W-series Servo Drives, the torque limit will be the lowest among all the limit values that are enabled for the torque limits specified in *Forward Torque Limit* (Pn402), *Reverse Torque Limit* (Pn403), *Forward Rotation External Current Limit* (Pn404), *Reverse Rotation External Current Limit* (Pn405), or in the option command value for speed control.

For G-series Servo Drives, the torque limit will be the lowest among all the limit values that are enabled for the torque limits specified in *No.1 Torque Limit* (Pn05E), *No.2 Torque Limit* (Pn05F), or in the option command value for speed control.

0: Torque limit function disabled

1: Torque limit function enabled

Details Refer to *10-4 Torque Limits*.

Positioning Proximity Flag (during Position Control)
Speed Limit Status Flag (during Torque Control)

Word b+1

Bit 11

Function The function of these flags depends on whether position control or torque control is being used.

During Position Control: Positioning Proximity Flag

This flag turns ON when the feedback position is within the range for Servo Parameter *Positioning Completion Range 2* (Pn504 for R88D-WT□ and Pn524 for R88D-WN□-ML2 and SMARTSTEP Junior) for the target (stop) position.

0: Outside *Positioning Completion Range 2*

1: Within *Positioning Completion Range 2*

During Torque Control: Speed Limit Status Flag

This flag turns ON when the feedback speed during torque control is limited by the Servo Parameter *Speed Limit* (Pn407), or option command value.

0: Speed limit function disabled

1: Speed limit function enabled

Details Refer to *10-6-2 Starting Torque Control*.

Forward Software Limit Flag and Reverse Software Limit Flag

Word b+1

Bits 12 and 13

Function These flags turn ON and OFF when the software limit function is enabled to indicate the present position status for the forward/reverse software limit.

Forward Software Limit Flag

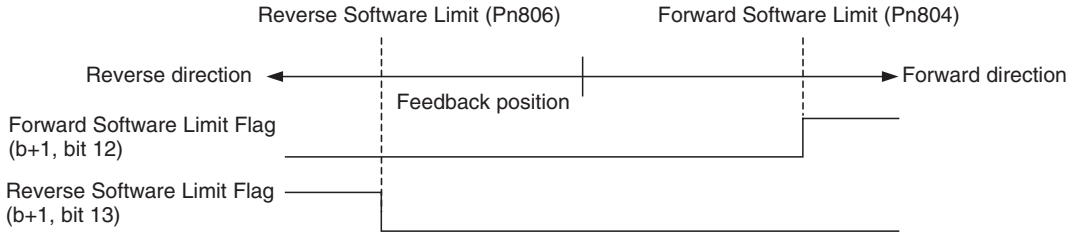
0: Within forward software limit range

1: Forward software limit range exceeded

Reverse Software Limit Flag

0: Within reverse software limit range

1: Reverse software limit range exceeded



Details Refer to *10-8 Software Limits*.

4-8-5 External I/O Status Bits

The External I/O Status Bits (word b + 3) show the I/O status of the I/O signals allocated to the Servo Drive.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	b+3	00	External I/O status	Forward rotation limit input	Returns the status of I/O signals for each axis. 1: Signal valid 0: Signal invalid The external I/O status shows the enabled/disabled status of signals used for PCU control. This status is different from the electrical ON/OFF status of the I/O signals.
		01		Reverse rotation limit input	
		02		Origin proximity input signal	
		03		Encoder Phase A input	
		04		Encoder Phase B input	
		05		Encoder Phase Z input	
		06		External latch signal 1 input	
		07		External latch signal 2 input	
		08		External latch signal 3 input	
		09		Brake output	
		10		Emergency stop input	
		11 to 15		Reserved by the system.	

Bit 10 (Emergency stop input) indicates the status of the emergency stop input signal input when using a G-series Servo Drive or SMARTSTEP Junior Servo Drive. This bit is always 0 when using a W-series Servo Drive, which does not have an emergency stop signal.

The SMARTSTEP Junior Servo Drive does not have inputs for external latch signals 2 and 3. When using a SMARTSTEP Junior Servo Drive, the input status for these signals will always be 0.

When using a W-series Servo Drive, the allocation and polarity of Servo Drive input signals can be set in the Servo Parameters, but the external I/O status depends on the polarity of the Servo Drive's input signals, as follows:

External I/O status	Signal	Servo Drive I/O signal name	Signal polarity: Normal (Setting: 0 to 6)		Signal polarity: Reverse (Setting: 9 to F)	
			Sensor status: Base block (not receiving power; Input open)	Sensor status: In operation (Input closed)	Sensor status: Base block (not receiving power; Input open)	Sensor status: In operation (Input closed)
Forward rotation limit input	POT	Forward drive prohibited	1	0	0	1
Reverse rotation limit input	NOT	Reverse drive prohibited	1	0	0	1
Origin proximity input	DEC	Origin return deceleration limit switch	0	1	1	0
External latch 1 input	EXT1	External latch 1 input	0	1	1	0
External latch 2 input	EXT2	External latch 2 input	0	1	1	0
External latch 3 input	EXT3	External latch 3 input	0	1	1	0

The forward rotation limit input (forward drive prohibited signal), and reverse rotation limit input (reverse drive prohibited signal) are normally-closed contact inputs (N.C. inputs) when polarity is normal. The origin proximity input (origin return deceleration limit switch), and external latch inputs (1 to 3) are normally-open contact inputs (N.O. inputs) when polarity is normal.

When using a SMARTSTEP Junior Servo Drive, the following status is shown. (With the SMARTSTEP Junior, signal polarity is fixed.)

External I/O status	Signal	Servo Drive I/O signal name	Sensor status: Base block (not receiving power; Input open)	Sensor status: In operation (Input closed)
Forward rotation limit input	POT	Forward drive prohibited	1	0
Reverse rotation limit input	NOT	Reverse drive prohibited	1	0
Origin proximity input	DEC	Origin proximity input	0	1
External latch 1 input	EXT1	External latch 1 input	0	1
Emergency stop input	STOP	Emergency stop input	1	0

4-8-6 Expanded Monitoring

The PCU has a fixed monitoring function that monitors the following control information for each axis and returns the result to the Axis Operating Input Memory Areas.

Axis control status (word b)

Servo status (word b + 1)

External I/O status (word b + 3)

Present position (Feedback present position: Words b + 6, b + 7; Command present position: Words b + 8, b + 9)

The PCU also has an expanded monitoring function that monitors control information selected from a number of categories, and returns the result to the Axis Operating Input Memory Areas.

The expanded monitoring function provides two monitors in the Axis Operating Input Memory Areas (Monitor 1: Words b + 10, b + 11; Monitor 2: Words b + 12, b + 13). The information to be monitored by each is selected using Monitor 1 type (Word a + 15, bits 00 to 03) and Monitor 2 type (Word a + 15, bits 04 to 07) in the Axis Operating Output Memory Areas.

Axis Operating Output Memory Area (Operating Commands)

Name	Word	Bits	Contents
Monitor 1 type	a+15	00 to 03	Used to select the type of control information to be returned to monitor 1.
Monitor 2 type		04 to 07	Used to select the type of control information to be returned to monitor 2.
Reserved by the system.		08 to 15	Not used. The setting is disabled.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Area (Monitoring)

Name	Word	Bits	Contents
Monitor 1 type	b+15	00 to 03	Indicates the type of control information selected by Monitor 1.
Monitor 2 type		04 to 07	Indicates the type of control information selected by Monitor 2.
Not used.		08 to 15	Always 0.
Monitor 1	b+10 b+11	---	Monitor 1 (rightmost word) Monitor 2 (leftmost word)
Monitor 2	b+12 b+13	---	Monitor 1 (rightmost word) Monitor 2 (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Monitor Type

The following control information can be selected for Monitor 1 and Monitor 2.

Monitor Type	Control information	Unit	Details
0	Command present position	Command unit	Returns the present position being sent to the Servo Drive. This value is the same as the command present position in words b + 8 and b + 9.
1	Reserved by the system.	---	Do not set.
2	Position deviation	Command unit	Returns the number of pulses remaining in the deviation counter of the Servo Drive in command units. Position deviation = Command present position − Feedback present position
3	Feedback present position	Command unit	Returns the actual position of the machine based on feedback from the Servomotor's encoder. This value is the same as the feedback present position in words b + 6 and b + 7.
4 to 5	Reserved by the system.	---	Do not set.

Monitor Type	Control information	Unit	Details
6	Target position	Command unit	Returns the target position (position command value) during positioning.
7	Reserved by the system.	---	Do not set.
8	Feedback speed	See note 1.	Returns the speed of the machine based on feedback from the Servomotor's encoder.
9	Command speed	See note 1.	Returns the speed designated for the Servo Drive.
A	Target speed	See note 1.	Returns the designated target speed (speed command value).
B	Torque command	See note 2.	Returns the torque command for the Servo Drive.
C to F	Reserved by the system.	---	Do not set.

Note (1) Speed Monitoring Unit
When the speed (feedback speed, command speed, or target speed) is selected for the monitor type, the monitoring unit for position control/ torque control, and speed control is as follows:

Control mode	Speed monitoring unit	Unit change timing
Position control Torque control	Command units/s	The unit changes when the command to switch to position control or torque control is received (when the Receiving Command Flag turns ON).
Speed control	0.001% (percentage of Servomotor's momentary maximum rotation speed)	The unit changes when the command for SPEED CONTROL is received (when the Receiving Command Flag turns ON).

For further details on operation timing, refer to *10-5 Speed Control*.

(2) Torque Monitoring Unit
When the torque is selected for the monitor type, the monitoring unit for position control, speed control, and torque control is as follows:

Control mode	Torque monitoring unit	Unit change timing
Position control Speed control	% (1% unit) (percentage of Servomotor's rated torque)	The unit changes when the command to switch to position control or speed control is received (when the Receiving Command Flag turns ON).
Torque control	0.001% (percentage of Servomotor's momentary maximum torque)	The unit changes when the command for TORQUE CONTROL is received (when the Receiving Command Flag turns ON).

For further details on operation timing, refer to *10-6 Torque Control*.

Note (1) Control data is used to monitor the control status of the Servo Drive. The resolution of the monitor value depends on the specifications of the connected Servo Drive.

Example: If a W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module is connected, the minimum resolution of the monitor values for feedback speed and command speed during position/torque control is 1,000 command units/s.

Depending on the length of the PLC cycle and MECHATROLINK communications cycle short-term changes of the Servo Drive status may not be monitored successfully.

(2) If MECHATROLINK communications are stopped (connection released) during speed or torque control and MECHATROLINK communications are restarted to execute SERVO LOCK (Servo ON), the power to the Servomotor will be recovered with the previous control mode maintained. At this point, the PCU cannot obtain correct monitor values for speed or torque monitor in its expanded monitoring.
To stop MECHATROLINK communications during SPEED CONTROL or TORQUE CONTROL execution, either execute DECELERATION STOP or EMERGENCY STOP, or execute SERVO UNLOCK, change to the position control mode, and then release the connection.

SECTION 5
Transferring and Saving Data

This section explains how to transfer and save parameters and data using the data transfer bits.

5-1 Transferring Data 202
5-2 Transferring PCU Parameters 204
5-2-1 Writing PCU Parameters 204
5-2-2 Reading PCU Parameters 207
5-2-3 Saving PCU Parameters 209
5-3 Transferring Servo Parameters 210
5-3-1 Writing Servo Parameters 211
5-3-2 Reading Servo Parameters 213
5-3-3 Saving Servo Parameters 215
5-3-4 Device Setup 218

5-1 Transferring Data

The following two types of data can be transferred by the Position Control Unit (PCU).

1,2,3...

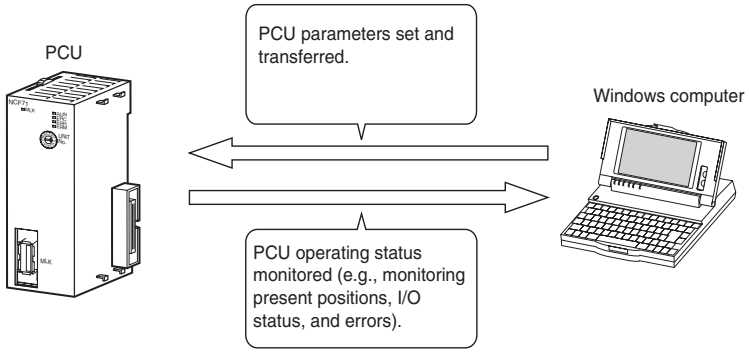
1. PCU Parameters
   - Common Parameters
   - Axis Parameters
2. Servo Drive Parameters
   - Servo Parameters

There are two ways to transfer these parameters.

- Using the Support Software to transfer parameters to and from a Windows computer connected to the CPU Unit
- Using the bits in the Operating Memory Areas allocated to the PCU in the CPU Unit to transfer parameters to and from I/O Memory in the CPU Unit

Transferring Parameters Using Support Software

The CX-Motion-NCF Support Software can be used on a Windows computer to set and transfer parameters for the PCU, to save and print the parameters, and to monitor PCU status.


PCU
PCU parameters set and transferred.
Windows computer
PCU operating status monitored (e.g., monitoring present positions, I/O status, and errors).

Refer to the *CX-Motion-NCF Operation Manual* (Cat. No. W436) for operating procedures and other information on the CX-Motion-NCF.

Transferring Parameters Using Bits in Operating Memory Areas

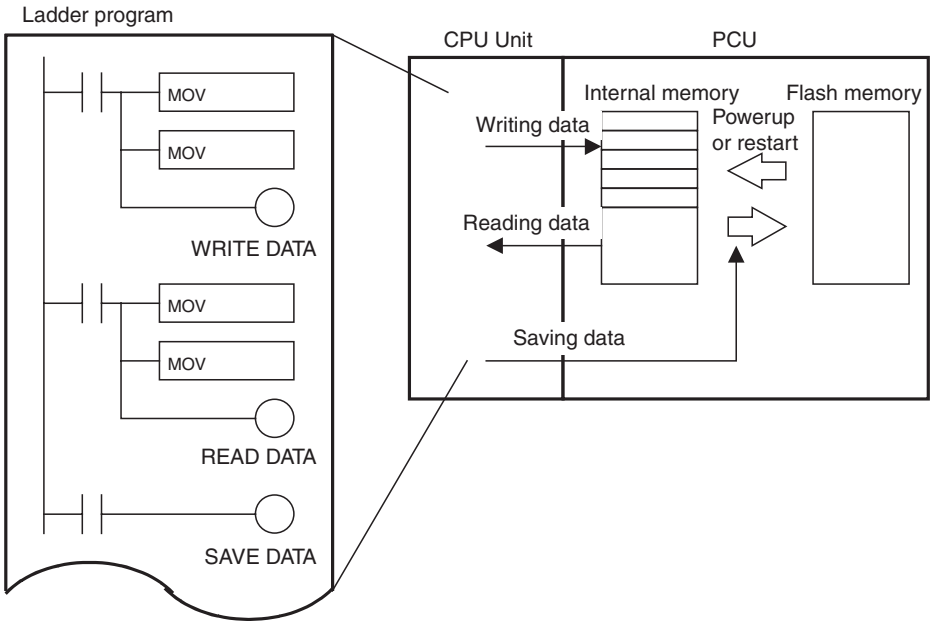
Bits in the Operating Memory Areas can be manipulated to transfer data between the CPU Unit and the PCU (and Servo Drives). The Common Operating Memory Area is used for parameters held in the PCU and the Axis Operating Memory Areas are used for parameters held in the Servo Drives.

Transferring PCU Parameters

Common Parameters and Axis Parameters are saved in the PCU's internal memory and also in the PCU's flash memory. These parameters are read/written, or saved to flash memory from the CPU Unit using the WRITE DATA, READ DATA, and SAVE DATA Bits allocated in the Common Operating Memory Area.

The number of transfer words, transfer source, and transfer destination are specified in the Common Operating Memory Area. It is possible to transfer multiple parameters at once.

For PCU parameters, the parameters stored in memory are saved altogether to the PCU's internal flash memory.



Transferring Servo Drive Parameters

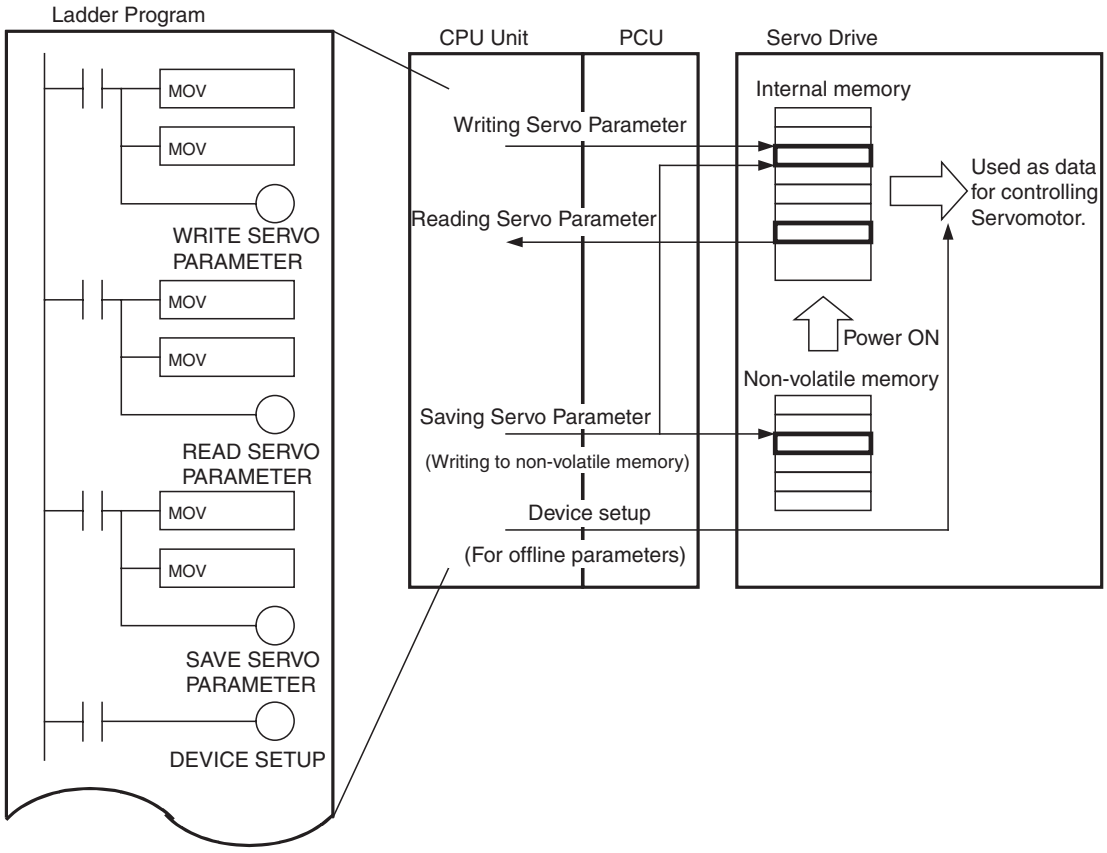
Servo Parameters are stored in internal memory of the Servo Drive connected to the PCU and then saved in the Servo Drive's non-volatile memory. These parameters are read/written or saved to the non-volatile memory from the CPU Unit using the WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER Bits allocated in the Axis Operating Memory Areas.

Servo Parameters for a single axis are written and read by parameter by specifying the parameter number. Parameters for different axes can be transferred at the same time.

Servo Parameters are saved by executing WRITE DATA to write them to the Servo Drive's non-volatile memory. Therefore, SAVE SERVO PARAMETER must be executed for each parameter separately from writing them to the Servo Drive's memory (WRITE SERVO PARAMETER).

Two types of Servo Parameters are transferred to the Servo Drive: online parameters with set values that are enabled immediately after they are written, and offline parameters, which are not enabled just by writing them. To enable set values for offline parameters in Servo Drive operations, save the parameters to the non-volatile memory, and then cycle the Servo Drive power. Alternatively, execute WRITE SERVO PARAMETER/SAVE SERVO PARAMETER and then execute the Servo Drive's DEVICE SETUP.

When DEVICE SETUP is executed, the Servo Drive enables all the Servo Parameters that are currently being transferred, and initializes the present position and output signal status to set the Servo Drive.



5-2 Transferring PCU Parameters

5-2-1 Writing PCU Parameters

The PCU's Common Parameters and Axis Parameters are written from the CPU Unit using the WRITE DATA Bit in the Common Operating Memory Area. The data to be transferred is set by specifying the number of transfer words, transfer source, and transfer destination in the Common Operating Memory Area. Multiple parameters can also be transferred all at once.

The PCU reads the contents of the Common Parameters and Axis Parameters saved in the internal flash memory when the PCU power is turned ON or the Unit is restarted, and enables them as operating parameters. Parameters transferred to the PCU using the WRITE DATA Bit will be lost if the PCU power is turned OFF or the Unit is restarted.

Note

(1) The Common Parameter set values are enabled by cycling the PCU power or restarting the Unit after executing WRITE DATA. Therefore, when the WRITE DATA Bit is used to change the contents of the Common Parameters, execute SAVE DATA and save the Common Parameters to the PCU's internal flash memory.

(2) The Axis Parameter settings are enabled when WRITE DATA execution has completed. To change Axis Parameter settings permanently, execute WRITE DATA followed by SAVE DATA (while MECHATROLINK communications are stopped) to save the Axis Parameter settings in the PCU's internal flash memory.

(3) Execute WRITE DATA to write data to the PCU while the Data Transferring Flag is OFF. Writing data to the PCU is disabled while the Busy Flag

is ON (when the PCU is in initial processing or reading or writing the back-up data from or to the Memory Card).

(4) If data is written while different data is being transferred, a Multistart Error (Unit error code: 0021) will occur and data will not be written to the PCU.

(5) Do not restart the PCU or turn OFF the power to the PLC while data is being written. The data will not be transferred correctly, and normal PCU operations may not be possible.

Data writing starts when the WRITE DATA Bit in the Common Operating Memory Area turns ON. When writing data to the PCU, make sure the WRITE DATA Bit remains ON until the Data Transferring Flag turns ON.

Up to 600 words can be transferred during a single data write operation. The maximum amount of data that can be transferred during a single CPU Unit cycle, however, is 20 words. When more than 20 words of data are transferred, the data is divided and WRITE DATA is executed over multiple cycles. When writing data to the PCU is completed, the Data Transferring Flag turns OFF.

Common Operating Memory Area (Output)

Name	Word	Bit	Contents
WRITE DATA Bit	n	01	0 → 1: Starts writing data.
Number of write words	n+6	---	Specifies the number of words to be written to the PCU. Up to 600 words can be transferred.
Write source area	n+7	---	Specifies the area of the data to be written to the PCU. The type of area set as the write source area is specified by specifying the beginning word of the area in the write source word in hexadecimal. Write source area: 00B0 hex: CIO Area 00B1 hex: Work Area 00B2 hex: Holding Area 00B3 hex: Auxiliary Area 0082 hex: DM Area 005□ hex: EM Area □: EM bank No.= 0 to 9, A, B, C
Write source word	n+8	---	
Write destination address	n+9	---	Specifies the write destination address in the PCU.

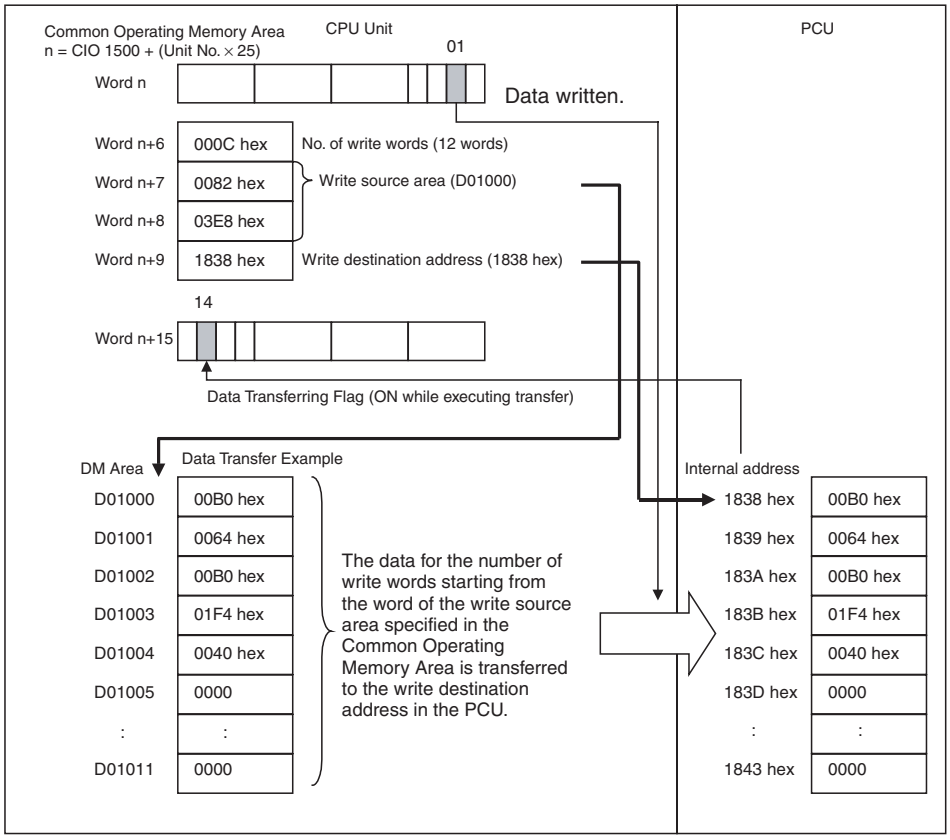
n = CIO 1500 + (unit number × 25)

Common Operating Memory Area (Input)

Name	Word	Bit	Contents
Data Transferring Flag	n+15	14	0: Powerup, transfer completed, or transfer failed 1: Transferring data
Unit Busy Flag	n+16	14	0: PCU is not busy 1: PCU is busy

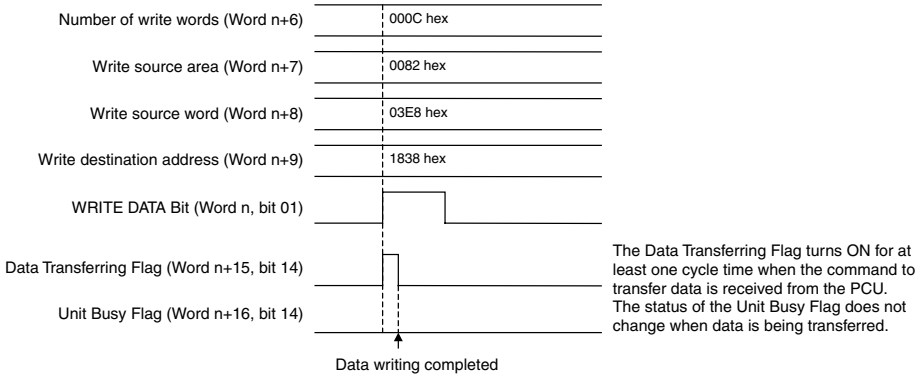
n = CIO 1500 + (unit number × 25)

The following diagram shows the operation for writing data to the PCU.



Timing Chart for Writing Data to the PCU

Data can be written to the PCU during axis operation if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). WRITE DATA, READ DATA, and SAVE DATA cannot be executed at the same time.


Number of write words (Word n+6)
000C hex
Write source area (Word n+7)
0082 hex
Write source word (Word n+8)
03E8 hex
Write destination address (Word n+9)
1838 hex
WRITE DATA Bit (Word n, bit 01)
Data Transferring Flag (Word n+15, bit 14)
Unit Busy Flag (Word n+16, bit 14)
The Data Transferring Flag turns ON for at least one cycle time when the command to transfer data is received from the PCU. The status of the Unit Busy Flag does not change when data is being transferred.
Data writing completed

When writing data to the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.

Note If an error occurs while writing data (multistart error, write transfer error, Common Parameter check error during data transfer, or Axis Parameter check error during data transfer), the transferred set value will be destroyed, and the parameter will return to the set value before transferring data. WRITE DATA is still executed if an error occurs, but even if the data is transferred normally, the error that occurred will not be cleared. Make sure to execute ERROR RESET

before WRITE DATA to enable identifying whether the data that was written has been transferred correctly.

5-2-2 Reading PCU Parameters

The PCU's Common Parameters and Axis Parameters are read to the CPU Unit using the READ DATA Bit in the Common Operating Memory Area. The data to be transferred is set by specifying the number of transfer words, transfer source, and transfer destination in the Common Operating Memory Area. Multiple parameters can also be transferred all at once.

Note

(1) Read data from the PCU when the Data Transferring Flag is OFF. READ DATA cannot be executed from the PCU while the Unit Busy Flag is ON (PCU initializing or reading/writing Memory Card backup data).

(2) If READ DATA is executed while data is being transferred, a Multistart Error (Unit error code: 0021) will occur and data will not be read from the PCU.

Data reading starts when the READ DATA Bit in the Common Operating Memory Area turns ON. When reading data from the PCU, make sure that the READ DATA Bit remains ON until the Data Transferring Flag turns ON.

Up to 600 words can be transferred during a single data reading operation. The maximum amount of data that can be transferred during a single CPU Unit cycle, however, is 20 words. When reading more than 20 words of data, the data is divided and read over multiple cycles. When reading data from the PCU is completed, the Data Transferring Flag turns OFF.

Common Operating Memory Area (Output)

Name	Word	Bit	Contents
READ DATA	n	02	0 → 1: Starts reading data
Number of read words	n+10	---	Specifies the number of words to be read from the PCU.
Read source address	n+11	---	Specifies the read source address in the PCU.
Read destination area	n+12	---	Specifies the area used to store the data read from the PCU. The type of area set as the read destination area is specified by specifying the beginning word of the area in the read destination word in hexadecimal. Read destination area: 00B0 hex: CIO Area 00B1 hex: Work Area 00B2 hex: Holding Area 00B3 hex: Auxiliary Area 0082 hex: DM Area 005□ hex: EM Area □: EM bank No.= 0 to 9, A, B, C
Read destination word	n+13	---	

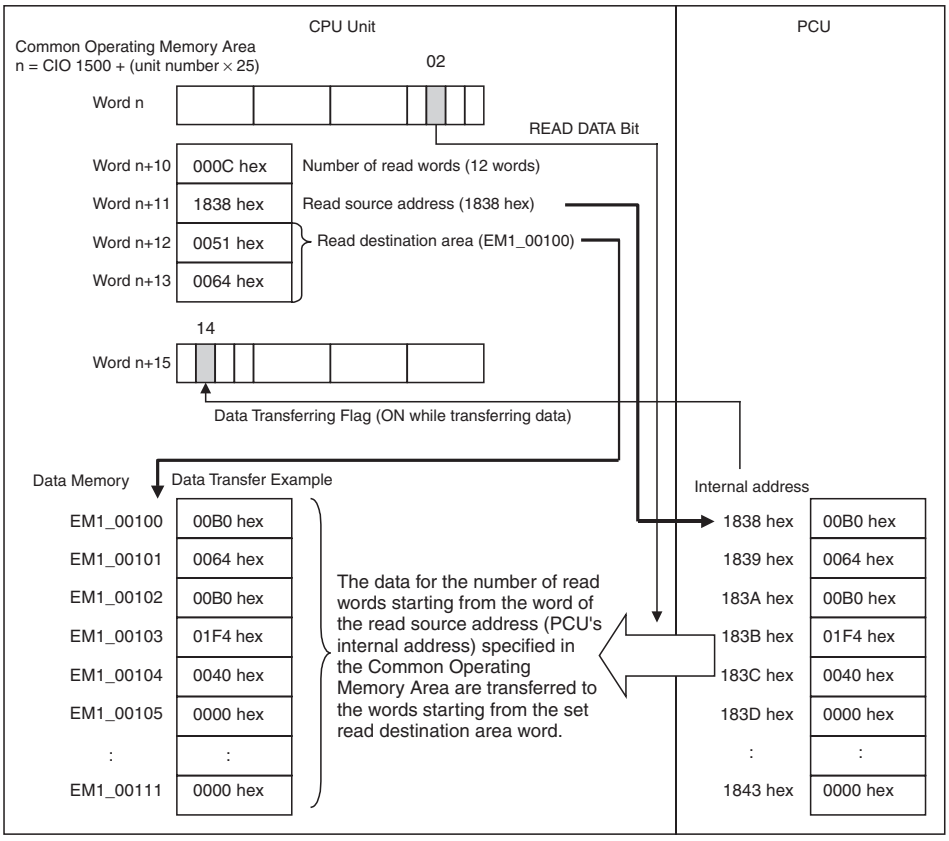
n = CIO 1500 + (unit number × 25)

Common Operating Memory Area (Input)

Name	Word	Bit	Contents
Data Transferring Flag	n+15	14	0: Powerup, transfer completed, or transfer failed 1: Transferring data
Unit Busy Flag	n+16	14	0: PCU is not busy 1: PCU is busy

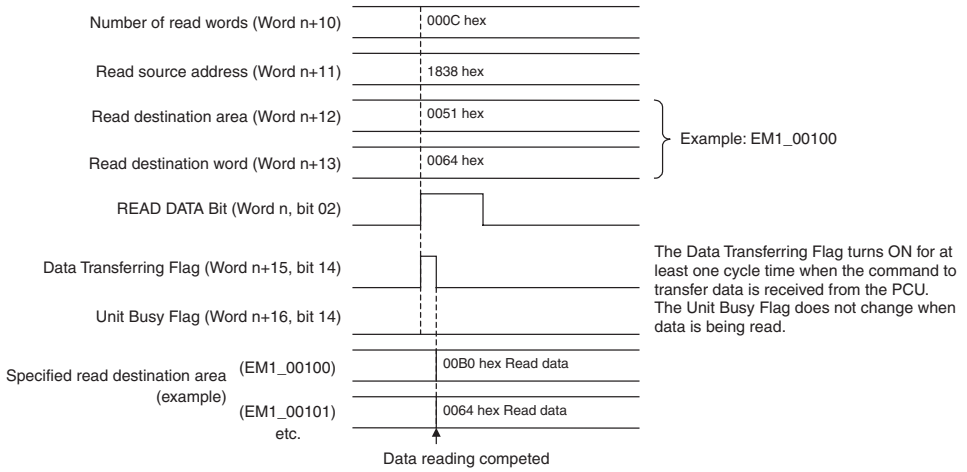
n = CIO 1500 + (unit number × 25)

The following diagram shows the operation for reading data from the PCU.


CPU Unit
PCU
Common Operating Memory Area
n = CIO 1500 + (unit number × 25)
02
Word n
READ DATA Bit
Word n+10
000C hex
Number of read words (12 words)
Word n+11
1838 hex
Read source address (1838 hex)
Word n+12
0051 hex
Word n+13
0064 hex
Read destination area (EM1_00100)
14
Word n+15
Data Transferring Flag (ON while transferring data)
Data Memory
Data Transfer Example
Internal address
EM1_00100 00B0 hex
EM1_00101 0064 hex
EM1_00102 00B0 hex
EM1_00103 01F4 hex
EM1_00104 0040 hex
EM1_00105 0000 hex
EM1_00111 0000 hex
1838 hex 00B0 hex
1839 hex 0064 hex
183A hex 00B0 hex
183B hex 01F4 hex
183C hex 0040 hex
183D hex 0000 hex
1843 hex 0000 hex
The data for the number of read words starting from the word of the read source address (PCU's internal address) specified in the Common Operating Memory Area are transferred to the words starting from the set read destination area word.

Timing Chart for Reading Data From the PCU

Data can be read from the PCU during axis operation if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). READ DATA, WRITE DATA, and SAVE DATA cannot be executed at the same time.


Number of read words (Word n+10)
000C hex
Read source address (Word n+11)
1838 hex
Read destination area (Word n+12)
0051 hex
Read destination word (Word n+13)
0064 hex
Example: EM1_00100
READ DATA Bit (Word n, bit 02)
Data Transferring Flag (Word n+15, bit 14)
Unit Busy Flag (Word n+16, bit 14)
The Data Transferring Flag turns ON for at least one cycle time when the command to transfer data is received from the PCU. The Unit Busy Flag does not change when data is being read.
Specified read destination area (example)
(EM1_00100)
00B0 hex Read data
(EM1_00101)
0064 hex Read data
etc.
Data reading competed

When reading data from the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.

Note If an error occurs when reading data (multistart error or read transfer error), the data will not be read from the PCU and the data in the read destination area will not be refreshed. READ DATA can still be executed if an error occurs, but even if the data is transferred normally, the error that occurred previously will not be cleared. Make sure to execute ERROR RESET before executing READ DATA to enable identifying whether the data that was read has been transferred correctly.

5-2-3 Saving PCU Parameters

When the power is turned ON, the PCU reads the Common Parameters and Axis Parameters saved in the PCU's flash memory to the PCU's internal memory and starts operations. The PCU's parameters are saved to the PCU's internal flash memory using the SAVE DATA Bit in the Common Operating Memory Area.

Note

(1) Save data to the PCU when MECHATROLINK communications are stopped and the Data Transferring Flag is OFF. The PCU's data cannot be saved while the Unit Busy Flag is ON (i.e., PCU initializing or reading/writing Memory Card backup data).

(2) If SAVE DATA is executed during MECHATROLINK communications or while data is transferring, a Multistart Error (Unit error code: 0021) will occur and data will not be saved to the PCU.

(3) Do not restart the PCU or turn OFF the power to the PLC while data is being saved. Doing so may result in damage to the PCU's internal flash memory and the PCU may not operate normally.

Data saving starts when the SAVE DATA Bit in the Common Operating Memory Area turns ON, at which time the enabled Common Parameters and Axis Parameters are saved to the PCU's internal flash memory all at once. When saving data to the PCU, make sure that the SAVE DATA Bit remains ON until the Data Transferring Flag turns ON.

Common Operating Memory Area (Output)

Name	Word	Bit	Contents
SAVE DATA	n	03	0 → 1: Starts saving data

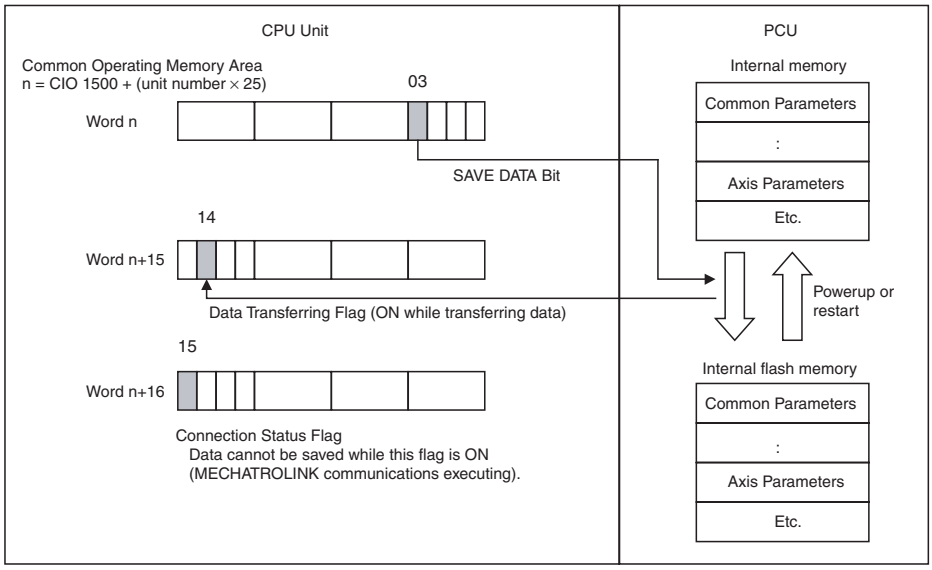
n = CIO 1500 + (unit number × 25)

Common Operating Memory Area (Input)

Name	Word	Bit	Contents
Data Transferring Flag	n+15	14	0: Powerup, saving completed, or saving failed 1: Saving data
Unit Busy Flag	n+16	14	0: PCU is not busy 1: PCU is busy
Connection Status Flag		15	0: MECHATROLINK communications stopped 1: MECHATROLINK communications executing

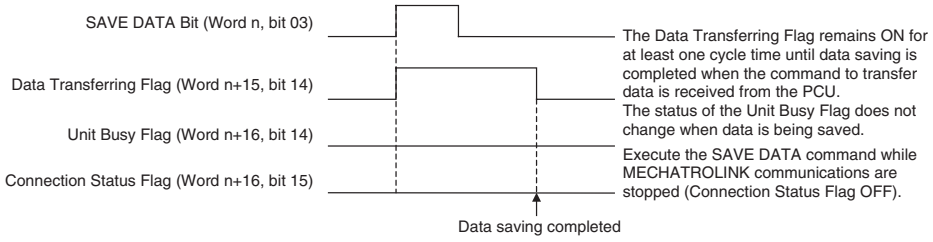
n = CIO 1500 + (unit number × 25)

The following diagram shows the operation for saving data in the PCU.



Timing Chart for Saving Data to the PCU

Data can be saved to the PCU while MECHATROLINK communications are stopped if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). SAVE DATA, WRITE DATA, and READ DATA cannot be executed at the same time.


SAVE DATA Bit (Word n, bit 03)
Data Transferring Flag (Word n+15, bit 14)
Unit Busy Flag (Word n+16, bit 14)
Connection Status Flag (Word n+16, bit 15)
The Data Transferring Flag remains ON for at least one cycle time until data saving is completed when the command to transfer data is received from the PCU.
The status of the Unit Busy Flag does not change when data is being saved.
Execute the SAVE DATA command while MECHATROLINK communications are stopped (Connection Status Flag OFF).
Data saving completed

When saving data to the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.

Note If an error occurs while SAVE DATA is executing (multistart error), the data will not be saved to the PCU's internal flash memory, and the parameter set values saved in flash memory will be those before SAVE DATA was executed. SAVE DATA is still executed if an error occurs, but even if the data is saved normally, the error that occurred will not be cleared. Make sure that SAVE DATA is executed after ERROR RESET to enable identifying whether data has been saved correctly.

5-3 Transferring Servo Parameters

Note Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Drive's operation manual and always check the effect of changing the settings before changing the Servo Parameters.

5-3-1 Writing Servo Parameters

Servo Parameters are written from the CPU Unit using the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Prepare the set values for the parameter number, parameter size (data length), and transfer data in the Axis Operating Output Memory Area and execute WRITE SERVO PARAMETER.

One execution of WRITE SERVO PARAMETER transfers one parameter for each axis. To transfer multiple parameters, WRITE SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can be written at the same time.

Parameters transferred using WRITE SERVO PARAMETER are written to the control memory in the Servo Drive. Therefore, online parameters that are overwritten are used immediately in Servo Drive control of the Servomotor. After executing WRITE SERVO PARAMETER for offline parameters, DEVICE SETUP must be executed to enable the settings.

When WRITE SERVO PARAMETER is executed, however, the settings are not saved in the Servo Drive's non-volatile memory. When the Servo Drive power is turned OFF, the set parameter settings will be lost and the next time the power is turned ON, operation will be performed using the parameters saved in the non-volatile memory. To save parameters in the Servo Drive's non-volatile memory, SAVE SERVO PARAMETER must be executed for each parameter separately from WRITE SERVO PARAMETER.

Note

(1) Execute WRITE SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If WRITE SERVO PARAMETER is executed while a Servo Parameter is being transferred, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be written.

(2) Do not restart the PCU or turn OFF the power to the PLC while writing a Servo Parameter. Doing so may result in parameters not being transferred correctly and cause unexpected operations.

Servo Parameter writing starts when the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing WRITE SERVO PARAMETER, make sure that the WRITE SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

Axis Operating Output Memory Area (Operating Commands)

Name	Word	Bit	Contents
WRITE SERVO PARAMETER Bit	a+1	12	0 → 1: Starts writing Servo Parameters
Servo Parameter No.	a+17	---	Specifies the parameter No. of the Servo Drive to which the data is to be written.
Parameter size	a+18	---	Specifies the data length of the parameter to be written in byte units.
Write data (rightmost word)	a+19	---	Specifies the setting data (hexadecimal) to be written to the Servo Parameters. For a parameter size of two bytes, the rightmost word is used only, and the data in the leftmost word is ignored. For a parameter size of four bytes, the four bytes of data from the rightmost to leftmost words are transferred.
Write data (leftmost word)	a+20	---	

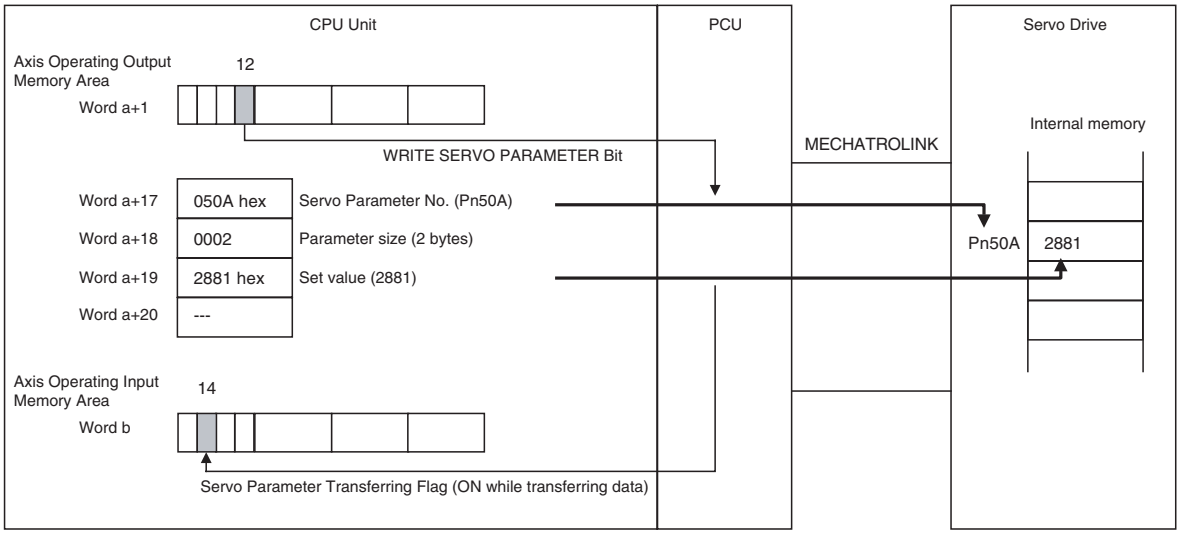
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Area (Monitoring)

Name	Word	Bit	Contents
Servo Parameter Transferring Flag	b	14	0: Powerup, transfer completed, or transfer failed 1: Transferring Servo Parameter

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The following diagram shows the operation used to write parameters to the W-series Servo Drive.



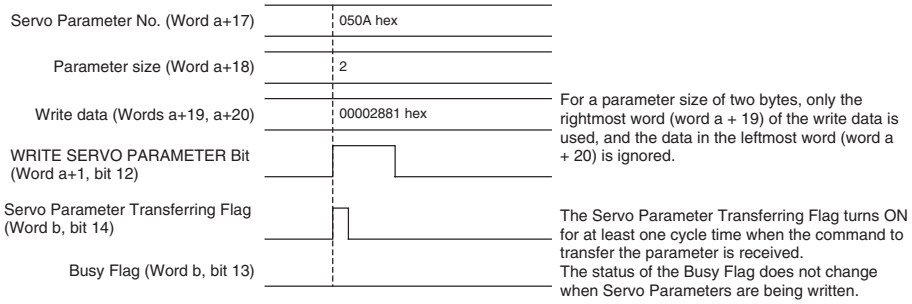
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No.−1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No.−1) × 25

Timing Chart for Writing Servo Parameters

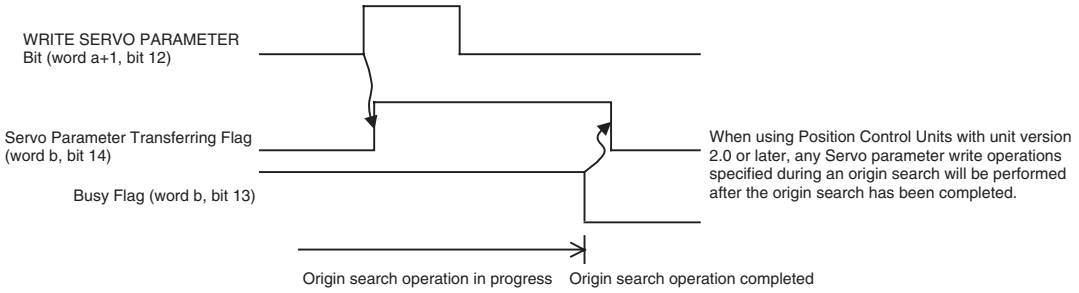
WRITE SERVO PARAMETER can also be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter write operations specified during an origin search will be performed after the origin search has been completed.

WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER cannot be executed on one axis at the same time.


Servo Parameter No. (Word a+17)
050A hex
Parameter size (Word a+18)
2
Write data (Words a+19, a+20)
00002881 hex
For a parameter size of two bytes, only the rightmost word (word a + 19) of the write data is used, and the data in the leftmost word (word a + 20) is ignored.
WRITE SERVO PARAMETER Bit (Word a+1, bit 12)
Servo Parameter Transferring Flag (Word b, bit 14)
The Servo Parameter Transferring Flag turns ON for at least one cycle time when the command to transfer the parameter is received.
Busy Flag (Word b, bit 13)
The status of the Busy Flag does not change when Servo Parameters are being written.

- Writing Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later


WRITE SERVO PARAMETER
Bit (word a+1, bit 12)
Servo Parameter Transferring Flag
(word b, bit 14)
Busy Flag (word b, bit 13)
When using Position Control Units with unit version 2.0 or later, any Servo parameter write operations specified during an origin search will be performed after the origin search has been completed.
Origin search operation in progress
Origin search operation completed

When writing a Servo Parameter is completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF. If an error occurs during Servo Parameter transfer, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code is input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

Note With PCUs of unit version 1.2 or earlier, WRITE SERVO PARAMETER cannot be executed when an axis error has occurred. WRITE SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, WRITE SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are transferred, however, the Error Flag can no longer be used to determine if an error has occurred during the transfer. It is thus necessary to write Servo Parameters after resetting the error or, if parameters are written when there is an axis error, then steps must be taken to confirm that the parameters were transferred correctly.

5-3-2 Reading Servo Parameters

Servo Parameters are read to the CPU Unit using the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Specify the parameter number and parameter size (data length) in the Axis Operating Output Memory Area and execute READ SERVO PARAMETER. The read parameter will be input in the Read data word of the Axis Operating Input Memory Area.

One execution of READ SERVO PARAMETER transfers one parameter for each axis. To transfer multiple parameters, READ SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can also be read at the same time.

Note Execute READ SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If READ SERVO PARAMETER is executed while a Servo Parameter is being transferred, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be read.

Servo Parameter reading starts when the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing READ SERVO PARAMETER, make sure that the READ SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

Axis Operating Output Memory Area (Operating Commands)

Name	Word	Bit	Contents
READ SERVO PARAMETER Bit	a+1	13	0 → 1: Starts reading Servo Parameter

Name	Word	Bit	Contents
Servo Parameter No.	a+17	---	Specifies the Servo Drive parameter No. from which the data is to be read.
Parameter size	a+18	---	Specifies the data length of the parameter to be read in byte units.

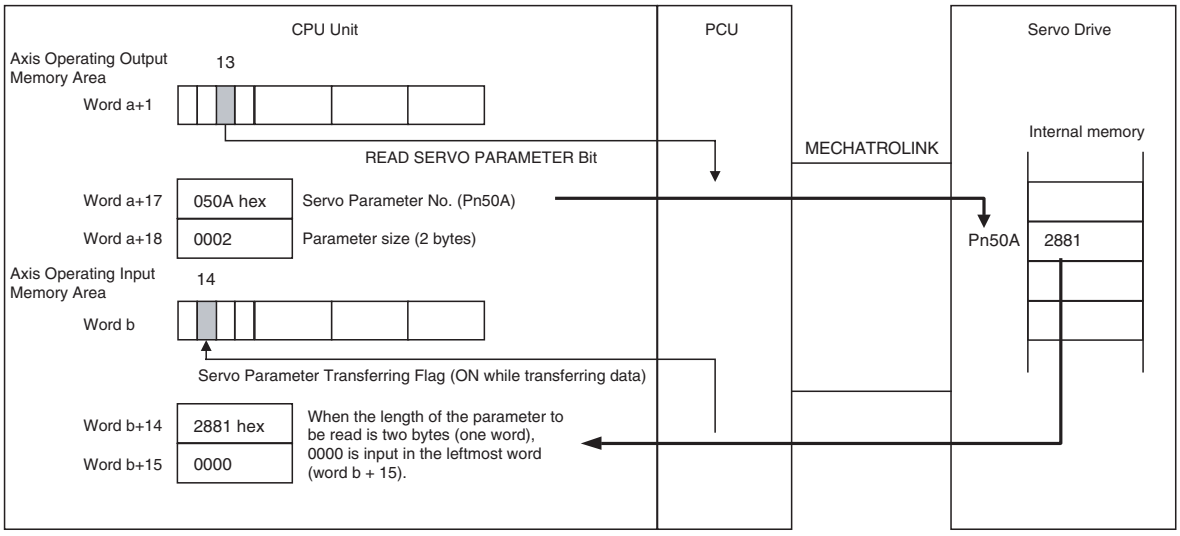
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Area (Monitoring)

Name	Word	Bit	Contents
Servo Parameter Transferring Flag	b	14	0: Powerup, transfer completed, or transfer failed 1: Transferring Servo Parameter
Read data (rightmost word)	b+14	---	Contains the Servo Parameter (hexadecimal) that was read. For a parameter size of two bytes, the rightmost word is used only, and 0000 is stored in the leftmost word. For a parameter size of four bytes, four bytes of data from the rightmost to leftmost words are stored.
Read data (leftmost word)	b+15	---	

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

READ SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON). The following diagram shows the operation used to read parameters to the Servo Drive.



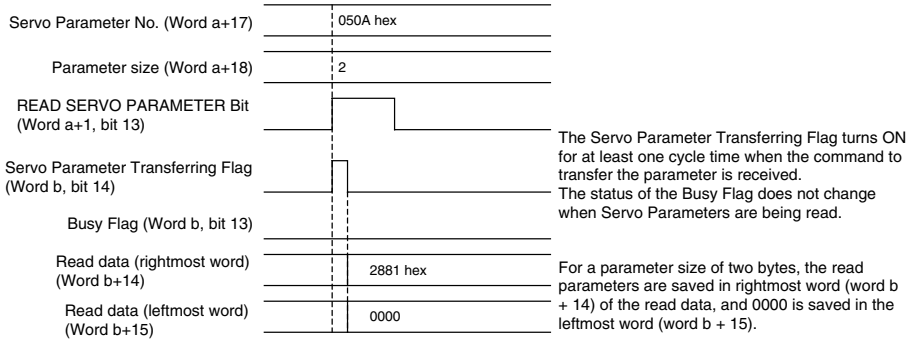
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart for Reading Servo Parameters

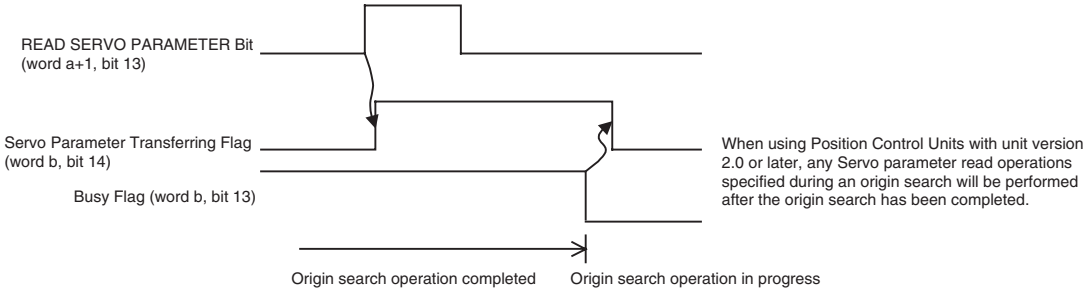
READ SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter read operations specified during an origin search will be performed after the origin search has been completed.

READ SERVO PARAMETER, WRITE SERVO PARAMETER, and SAVE SERVO PARAMETER cannot be executed on one axis at the same time.


Servo Parameter No. (Word a+17)
050A hex
Parameter size (Word a+18)
2
READ SERVO PARAMETER Bit (Word a+1, bit 13)
Servo Parameter Transferring Flag (Word b, bit 14)
Busy Flag (Word b, bit 13)
Read data (rightmost word) (Word b+14)
2881 hex
Read data (leftmost word) (Word b+15)
0000
The Servo Parameter Transferring Flag turns ON for at least one cycle time when the command to transfer the parameter is received.
The status of the Busy Flag does not change when Servo Parameters are being read.
For a parameter size of two bytes, the read parameters are saved in rightmost word (word b + 14) of the read data, and 0000 is saved in the leftmost word (word b + 15).

- Reading Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later


READ SERVO PARAMETER Bit (word a+1, bit 13)
Servo Parameter Transferring Flag (word b, bit 14)
Busy Flag (word b, bit 13)
When using Position Control Units with unit version 2.0 or later, any Servo parameter read operations specified during an origin search will be performed after the origin search has been completed.
Origin search operation completed
Origin search operation in progress

When READ SERVO PARAMETER execution is completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF, and the contents of the parameter that has been read is stored in the read data words (words b+14, b+15).

If an error occurs while transferring Servo Parameters, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code will be input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

Note With PCUs of unit version 1.2 or earlier, READ SERVO PARAMETER cannot be executed when an axis error has occurred. READ SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, READ SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are transferred, however, the Error Flag can no longer be used to determine if an error has occurred during the transfer. It is thus necessary to read Servo Parameters after resetting the error or, if parameters are read when there is an axis error, then steps must be taken to confirm that the parameters were transferred correctly.

5-3-3 Saving Servo Parameters

When Servo Parameters are saved in the Servo Drive's non-volatile memory, the settings are held even after the power is turned OFF and the next time the power is turned ON, the previous settings will be recovered. Saving Servo Parameter is treated as writing data to the Servo Drive's non-volatile memory. Therefore, SAVE SERVO PARAMETER must be executed separately from WRITE SERVO PARAMETER for each parameter.

Servo Parameters are saved from the CPU Unit using the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Specify the parameter number, parameter size (data length), and data to be transferred in the Axis Operating Output Memory Area and execute SAVE SERVO PARAMETER (to write settings to non-volatile memory).

One execution of SAVE SERVO PARAMETER transfers one parameter for each axis. The parameter is written to the Servo Drive's internal memory at the same time as saving it in the non-volatile memory. To save multiple parameters, SAVE SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can be saved at the same time.

Note

(1) There is a limit to the number of times non-volatile memory in the Servo Drive can be written (10,000 times). When Servo parameters are changed frequently during system operation, so not save the parameters, but rather just write them.

(2) Execute SAVE SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If SAVE SERVO PARAMETER is executed while the Servo Parameter Transferring Flag is ON, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be saved.

(3) Do not restart the PCU or turn OFF the power to the PLC while a Servo Parameter is being saved. Doing so may result in the parameter not being saved correctly and cause unexpected operations.

Servo Parameter saving starts when the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing SAVE SERVO PARAMETER, make sure that the SAVE SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

Axis Operating Output Memory Area (Operating Commands)

Name	Word	Bit	Contents
SAVE SERVO PARAMETER Bit	a+1	14	0 → 1: Starts writing Servo Parameter to non-volatile memory.
Servo Parameter No.	a+17	---	Specifies the parameter No. of the Servo Drive to which the data is to be written.
Parameter size	a+18	---	Specifies the data length of the parameter to be written in byte units.
Write data (rightmost word)	a+19	---	Specifies the setting data (hexadecimal) to be written to the Servo Parameter. For a parameter size of two bytes, the rightmost word is used only, and the data in the leftmost word is ignored. For a parameter size of four bytes, four bytes of data from the rightmost to leftmost words are transferred.
Write data (leftmost word	a+20	---	

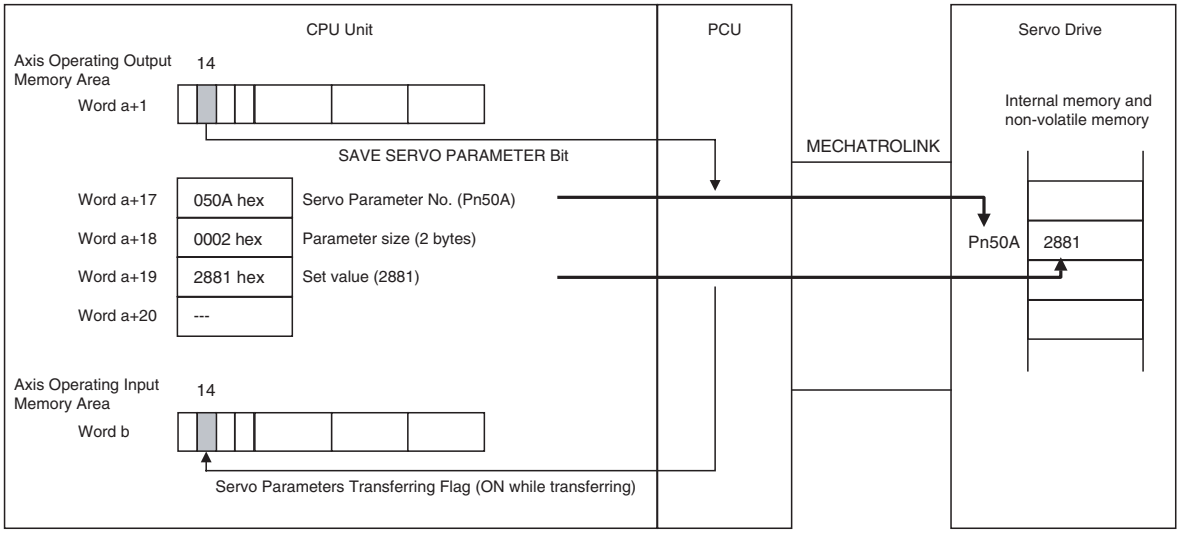
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Area (Monitoring)

Name	Word	Bit	Contents
Servo Parameter Transferring Flag	b	14	0: Powerup, transfer completed, or transfer failed 1: Transferring Servo Parameter

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

SAVE SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON). The following diagram shows the operation used to save parameters to the W-series Servo Drive.



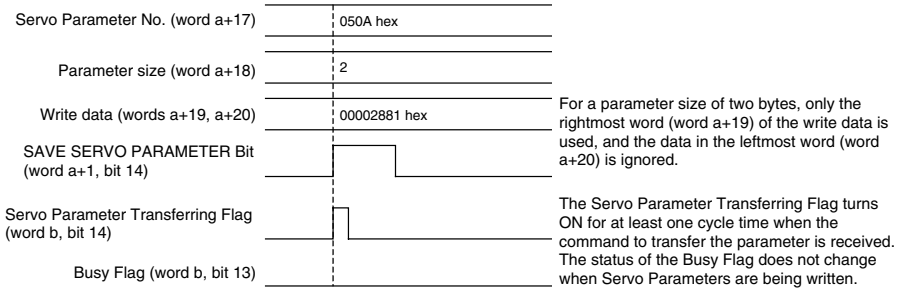
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart for Saving Servo Parameters

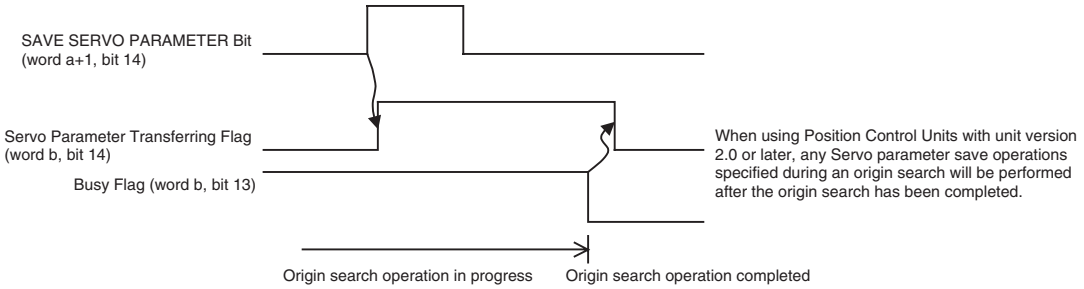
SAVE SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter save operations specified during an origin search will be performed after the origin search has been completed.

SAVE SERVO PARAMETER, WRITE SERVO PARAMETER, and READ SERVO PARAMETER cannot be executed on one axis at the same time.


Servo Parameter No. (word a+17)
050A hex
Parameter size (word a+18)
2
Write data (words a+19, a+20)
00002881 hex
SAVE SERVO PARAMETER Bit (word a+1, bit 14)
Servo Parameter Transferring Flag (word b, bit 14)
Busy Flag (word b, bit 13)
For a parameter size of two bytes, only the rightmost word (word a+19) of the write data is used, and the data in the leftmost word (word a+20) is ignored.
The Servo Parameter Transferring Flag turns ON for at least one cycle time when the command to transfer the parameter is received. The status of the Busy Flag does not change when Servo Parameters are being written.

- Saving Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later


SAVE SERVO PARAMETER Bit (word a+1, bit 14)
Servo Parameter Transferring Flag (word b, bit 14)
Busy Flag (word b, bit 13)
When using Position Control Units with unit version 2.0 or later, any Servo parameter save operations specified during an origin search will be performed after the origin search has been completed.
Origin search operation in progress
Origin search operation completed

When execution of SAVE SERVO PARAMETER has completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF.

If an error occurs while executing SAVE SERVO PARAMETER, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code will be input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

Note With PCUs of version 1.2 or earlier, SAVE SERVO PARAMETER cannot be executed if an axis error has occurred. SAVE SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, SAVE SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are saved, however, the Error Flag can no longer be used to determine if an error has occurred during the save. It is thus necessary to save Servo Parameters after resetting the error or, if parameters are saved when there is an axis error, then steps must be taken to confirm that the parameters were saved correctly.

5-3-4 Device Setup

Two types of Servo Parameters are transferred to the Servo Drive: online parameters with set values that are enabled immediately after they are written, and offline parameters, which are not enabled just by writing them. To enable set values for offline parameters in Servo Drive operations, save the parameters to the non-volatile memory, and then cycle the Servo Drive power. Alternatively, execute WRITE SERVO PARAMETER/SAVE SERVO PARAMETER and then execute the Servo Drive's DEVICE SETUP.

When DEVICE SETUP is executed, the Servo Drive enables all the Servo Parameters that have been transferred to set the Servo Drive, and initializes the present position and output signal status. DEVICE SETUP can be executed in Servo unlock status. If DEVICE SETUP is executed while in Servo lock status, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.

DEVICE SETUP is executed from the CPU Unit using the DEVICE SETUP Bit in the Axis Operating Output Memory Area. DEVICE SETUP can be executed for different axes at the same time.

Note Execute DEVICE SETUP when the Busy Flag for the corresponding axis is OFF. If DEVICE SETUP is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.

Device setup starts when the DEVICE SETUP Bit in the Axis Operating Output Memory Area turns ON. When executing the DEVICE SETUP command, make sure that the DEVICE SETUP Bit remains ON until the Busy Flag in the Axis Operating Input Memory Area turns ON.

Axis Operating Output Memory Area (Operating Commands)

Name	Word	Bit	Contents
DEVICE SETUP Bit	a+1	11	0 → 1: Starts device setup for the Servo Drive.

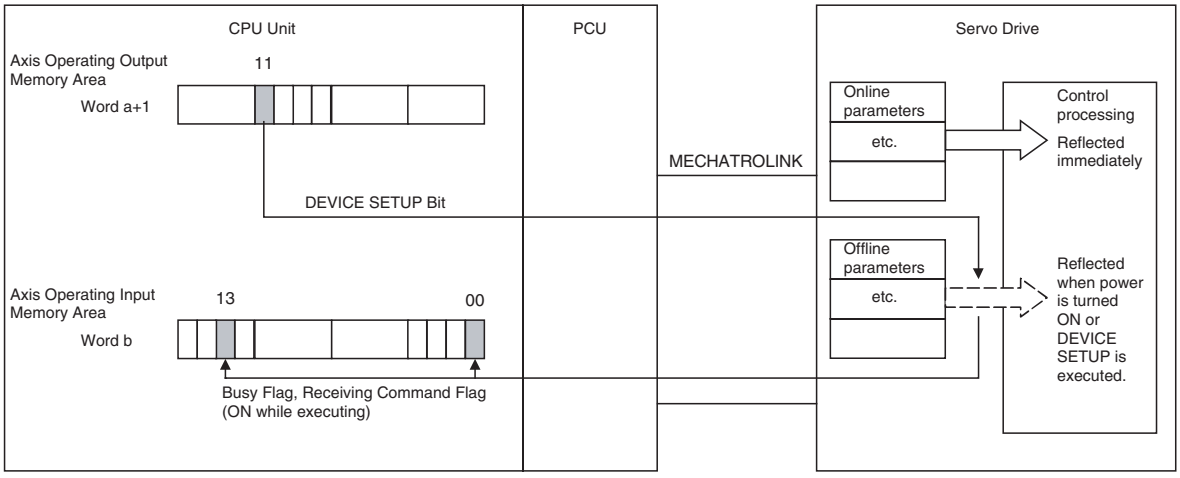
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Area (Monitoring)

Name	Word	Bit	Contents
Receiving Command Flag	b	00	0: Command reception enabled 0 → 1: Command reception started 1: Receiving command (command reception disabled)
Busy Flag		13	1: Axis busy (axis operation executing)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

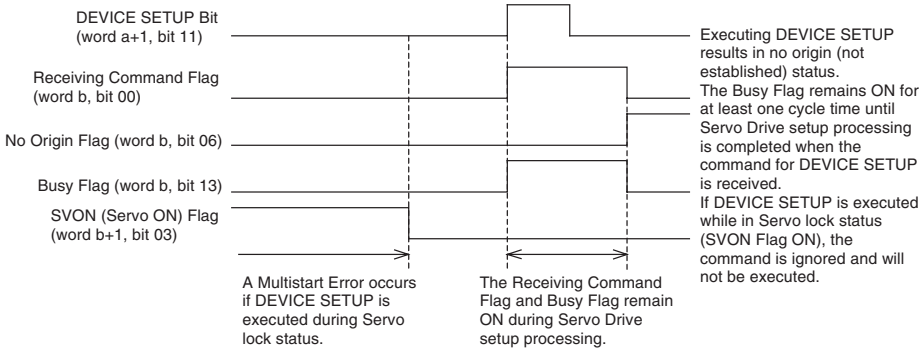
The following diagram shows the device setup operation for the Servo Drive.



a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart for DEVICE SETUP

DEVICE SETUP can be executed when the corresponding axis is in Servo unlocked status and the Busy Flag is not ON. If DEVICE SETUP is executed while in Servo lock status, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.


DEVICE SETUP Bit (word a+1, bit 11)
Receiving Command Flag (word b, bit 00)
No Origin Flag (word b, bit 06)
Busy Flag (word b, bit 13)
SVON (Servo ON) Flag (word b+1, bit 03)
Executing DEVICE SETUP results in no origin (not established) status.
The Busy Flag remains ON for at least one cycle time until Servo Drive setup processing is completed when the command for DEVICE SETUP is received.
If DEVICE SETUP is executed while in Servo lock status (SVON Flag ON), the command is ignored and will not be executed.
A Multistart Error occurs if DEVICE SETUP is executed during Servo lock status.
The Receiving Command Flag and Busy Flag remain ON during Servo Drive setup processing.

During DEVICE SETUP processing, the Receiving Command Flag (word b, bit 00) and Busy Flag (word b, bit 13) remain ON. When DEVICE SETUP execution is completed, both of these Flags turn OFF. When DEVICE SETUP is executed, the origin is lost (No Origin Flag turns ON), and the present position becomes undefined. After DEVICE SETUP is executed, establish the origin again.

During execution of DEVICE SETUP, the Servo status and Servo Drive output signals become undefined.

Note DEVICE SETUP cannot be executed if an axis error has occurred. DEVICE SETUP will be ignored if it is executed during an axis error.

SECTION 6
MECHATROLINK

This section provides an overview of MECHATROLINK communications, and includes information on settings and procedures required to use MECHATROLINK with the Position Control Unit.

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6-1 MECHATROLINK Overview

MECHATROLINK

The Position Control Unit (PCU) uses MECHATROLINK (see note) to connect to the Servo Drive.

Note MECHATROLINK is a registered trademark of Yaskawa Electric Corporation.

MECHATROLINK is a high-speed field network developed by Yaskawa Electric Corporation. High-speed, high-precision motion control is possible for up to 30 (see note) MECHATROLINK-compatible devices connected to a single communications line using high-speed communications of up to 10 Mbps.

Note Up to 16 Servo Drives can be connected to the CS1W/CJ1W-NCF71, up to 2 Servo Drives can be connected to the CS1W/CJ1W-NC271, and up to 4 Servo Drives can be connected to the CS1W/CJ1W-NC471. The highest axis number that can be set in the Position Control Unit is 16.

MECHATROLINK is available with two baud rates: 4 Mbps for MECHATROLINK-I and 10 Mbps for MECHATROLINK-II. This PCU is designed for MECHATROLINK-II. The connected devices must be compatible with MECHATROLINK-II.

In this manual, the use of MECHATROLINK refers to MECHATROLINK-II unless otherwise specified.

MECHATROLINK Specifications

Item	Specifications
Communications protocol	MECHATROLINK-II
Baud rate	10 Mbps
Maximum transmission distance	50 m (See note 1.)
Minimum distance between stations	0.5 m
Transmission media	Shielded, twisted-pair cables
Maximum No. of stations	30 slave stations max. (See note 2.)
Topology	Bus
Transfer cycle	250 μs to 8 ms
Communications method	Master-slave, totally synchronous
Encoding	Manchester encoding
Data length	17 bytes/32 bytes selectable (See note 3.)

Note

(1) This distance is the total length of the cable connected between devices. However, the maximum length depends on the number of devices connected and whether Repeaters are used. For details, refer to *3-4-1 MECHATROLINK-II Communications Wiring*.

(2) Up to 16 devices can be connected to the CS1W/CJ1W-NCF71, up to 2 devices can be connected to the CS1W/CJ1W-NC271, and up to 4 devices can be connected to the CS1W/CJ1W-NC471.

(3) The PCU data length is fixed at 32 bytes.

MECHATROLINK-compatible Devices Supported by PCU

This PCU is designed to be used with MECHATROLINK-II. The maximum number of stations that can be connected to the PCU is 16, and the station addresses of the MECHATROLINK-compatible devices must be set in the range 1 to 16. The MECHATROLINK-II communications settings at the PCU are fixed, as follows:

Item	Specifications
Baud rate	10 Mbps
Data length	32 bytes (fixed) (See note.)

Note Some devices indicate the data length as 30 bytes, but the meaning is the same.

Make sure that the baud rates and number of transmission bytes for the MECHATROLINK-compatible devices connected to the PCU are set to the same settings as shown in the above table.

The MECHATROLINK-compatible devices that can be connected to the PCU are shown in the following table.

Category	Compatible devices
Servo Drive	R88D-GN□-ML2 OMRON G-series Servo Drives (with MECHATROLINK-II communications)
	R88D-WT□ OMRON W-series Servo Drives (equipped with JUSP-NS115 YASKAWA MECHATROLINK-II Application Module)
	R88D-WN□-ML2 OMRON W-series Servo Drives (equipped with built-in MECHATROLINK-II communications)
	R7D-ZN□-ML2 OMRON SMARTSTEP Junior Servo Drives (equipped with built-in MECHATROLINK-II communications)

The version of R88D-WT□ W-series Servo Drives used must support JUSP-NS115 MECHATROLINK-II Application Modules. JUSP-NS115 MECHATROLINK-II Application Modules can be installed in R88D-WT□ W-series Servo Drives with version 39 or later. (For details, refer to *3-1-2 MECHATROLINK-II Application Module*.) The version of R88D-WT□ W-series Servo Drives is shown on the nameplate located on the side of the Servo Drive. Make sure that the Servo Drive is version 39 or later. Earlier versions will not function properly.

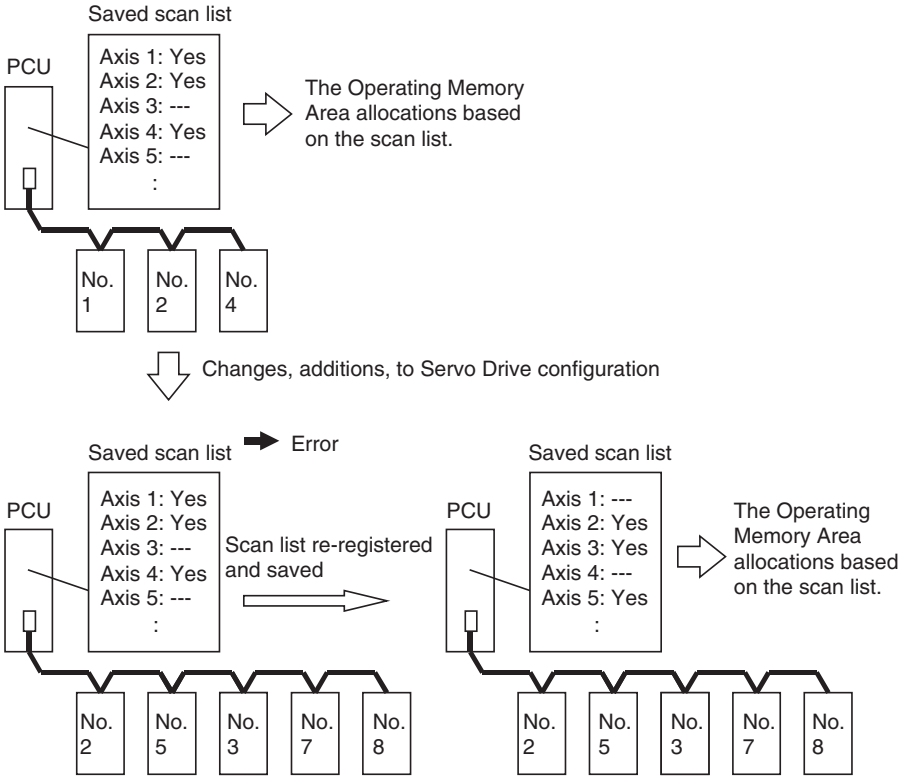
6-2 MECHATROLINK Settings

The settings required to use MECHATROLINK with the PCU are described here.

6-2-1 Scan List

The scan list is used to register the MECHATROLINK devices connected to the PCU. The PCU connects the axes registered in the scan list to MECHATROLINK communications, detects these axes, and monitors communications for them.

The PCU receives positioning commands allocated in the Work Area (Axis Operating Memory Area) of the CPU Unit and controls positioning of the Servo Drive. The Axis Operating Memory Areas are allocated based on the scan list that is saved in the PCU's internal flash memory. Therefore, to use the PCU, first the scan list must be created and saved, and the connected Servo Drives must be registered in the list.



The station address numbers set at the MECHATROLINK device slave stations correspond to the axis numbers registered in the PCU's scan list, regardless of the physical order in which the devices are connected to the MECHATROLINK communications line. The scan list is set as the Common Parameters for the PCU.

The axes are allocated eight bits per axis in the eight words of data in the PCU's internal addresses from 183C to 1843 hex, as shown in the following table. To allocate an axis to the Servo Drive, set the data to 40 hex and when an axis is not used, set the data to 00 hex. (Nothing is registered for the default setting.) Up to 16 axes can be allocated for the CS1W/CJ1W-NCF71, up to 2 axes can be allocated for the CS1W/CJ1W-NC271, and up to 4 axes can be allocated for the CS1W/CJ1W-NC471. An error will occur if you allocate more axes than your Unit supports. The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

PCU's address	Contents		Setting
	Bits 08 to 15	Bits 00 to 07	
183C hex	Axis 2 allocation	Axis 1 allocation	00 hex: Axis not used (default setting). 40 hex: Allocates axis to the Servo Drive
183D hex	Axis 4 allocation	Axis 3 allocation	
183E hex	Axis 6 allocation	Axis 5 allocation	
183F hex	Axis 8 allocation	Axis 7 allocation	
1840 hex	Axis 10 allocation	Axis 9 allocation	
1841 hex	Axis 12 allocation	Axis 11 allocation	
1842 hex	Axis 14 allocation	Axis 13 allocation	
1843 hex	Axis 16 allocation	Axis 15 allocation	

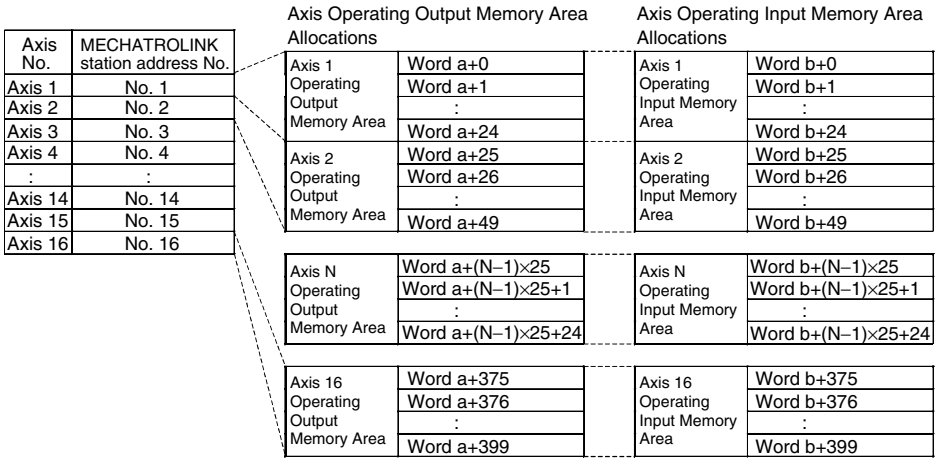
6-2-2 Scan List and PCU Area Allocations

Words are allocated to the PCU in the Work Area in the CPU Unit for use as Axis Operating Output Memory Areas and Axis Operating Input Memory Areas for the Servo Drives registered in the scan list. An output area of 25 words and an input area of 25 words are allocated to each axis according to the axis number registered in the scan list. The beginning word of these output areas and input areas can be set by the user in the Common Parameter Area.

The output areas and input area allocations are specified in the four words of data in the PCU's internal addresses from 1838 to 183B hex, as shown in the following table. The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

PCU's address	Contents	Setting
1838 hex	Axis Operating Output Memory Area designation	Specifies the words allocated for the Axis Operating Output Memory Areas. 0000 hex: No setting (default) 00B0 hex: CIO Area 00B1 hex: Work Area 00B2 hex: Holding Area 00B3 hex: Auxiliary Area 0082 hex: DM Area 0050 to 0059, 005A,005B, 005C hex: EM Area (5□: □ = EM Bank No.)
1839 hex	Beginning word of Axis Operating Output Memory Areas	Specifies the beginning word of the Axis Operating Output Memory Areas. The beginning word of the Operating Output Memory Area for axis 1 is determined by the Axis Operating Output Memory Area designation and the word determined using this parameter. Each axis is allocated 25 words in sequence from this word.
183A hex	Axis Operating Input Memory Area designation	Specifies the words allocated for the Axis Operating Input Memory Areas. The setting method is the same as for the Axis Operating Output Memory Areas.
183B hex	Beginning word of Axis Operating Input Memory Areas	Specifies the beginning word of the Axis Operating Input Memory Areas. The setting method is the same as for the Axis Operating Output Memory Areas.

The Axis Operating Memory Output and Input Areas are allocated words for each axis from axis 1 up to the highest axis number registered in the scan list. Axis numbers between axis 1 and the highest registered axis number that are not registered as MECHATROLINK devices are also each allocated 25 output words and 25 input words.



Axis No.	MECHATROLINK station address No.
Axis 1	No. 1
Axis 2	No. 2
Axis 3	No. 3
Axis 4	No. 4
:	:
Axis 14	No. 14
Axis 15	No. 15
Axis 16	No. 16

Axis Operating Output Memory Area Allocations

Axis 1 Operating Output Memory Area	Word a+0
	Word a+1
	:
	Word a+24
Axis 2 Operating Output Memory Area	Word a+25
	Word a+26
	:
	Word a+49
Axis N Operating Output Memory Area	Word a+(N−1)×25
	Word a+(N−1)×25+1
	:
	Word a+(N−1)×25+24
Axis 16 Operating Output Memory Area	Word a+375
	Word a+376
	:
	Word a+399

Axis Operating Input Memory Area Allocations

Axis 1 Operating Input Memory Area	Word b+0
	Word b+1
	:
	Word b+24
Axis 2 Operating Input Memory Area	Word b+25
	Word b+26
	:
	Word b+49
Axis N Operating Input Memory Area	Word b+(N−1)×25
	Word b+(N−1)×25+1
	:
	Word b+(N−1)×25+24
Axis 16 Operating Input Memory Area	Word b+375
	Word b+376
	:
	Word b+399

a = Beginning word of Axis Operating Output Areas specified in Common Parameters
b = Beginning word of Axis Operating Input Areas specified in Common Parameters

Example:
Beginning word of Axis Operating Output Memory Areas: CIO 100
Beginning word of Axis Operating Input Memory Areas: CIO 500
Station addresses of connected MECHATROLINK devices (registered in scan list): No. 2, No. 5, and No. 7
In this example, the words occupied as Axis Operating Memory Areas are as follows:

Axis Operating Output Memory Area: CIO 100 to CIO 274 (Axes 1 to 7)
Axis Operating Input Memory Area: CIO 500 to CIO 674 (Axes 1 to 7)
Axis 2 Output Area: CIO 125 to CIO 149;
Axis 2 Input Area: CIO 525 to CIO 549
Axis 5 Output Area: CIO 200 to CIO 224;
Axis 5 Input Area: CIO 600 to CIO 624
Axis 7 Output Area: CIO 250 to CIO 274;
Axis 7 Input Area: CIO 650 to CIO 674

Axes 1, 3, 4, and 6 are not used, but are still allocated words in the PCU. These words cannot be used as work words.

Note Set the beginning word of the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas in the Common Parameters so that the words allocated to each area do not exceed the range for each of the CPU Unit's I/O memory areas. If the setting exceeds the range of the I/O memory area, an Initialization Common Parameter Check Error (Unit error code: 0028) will occur when the PCU power is turned ON or the Unit is restarted.

Example:
Beginning word of the Axis Operating Output Memory Areas: CIO 6100
Connected axes: 2 min.

Axis 1: Output Area: CIO 6100 to CIO 6124
Axis 2: Output Area: CIO 6125 to CIO 6149
Etc.

Areas for subsequent axes are allocated in sequence. The highest word in the CIO Area is CIO 6143. Therefore, an error will occur. If the ranges set for the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas overlap, an Initialization Common Parameter Check Error (Unit error code: 0028) will occur when the PCU power is turned ON or the Unit is restarted.

6-2-3 MECHATROLINK Communications Settings

In addition to the scan list, the following four PCU settings are also for MECHATROLINK communications.

- Transfer cycle
- Communications cycle
- Number of communications retries
- C2 master connection

Of these settings, the transfer cycle and communications cycle must always be set when using the PCU. The settings for MECHATROLINK communications are set as the PCU's Common Parameters.

Set the two words of data in the PCU's internal addresses 1856 hex and 1857 hex as shown in the following table. The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

<table>
<tr><th rowspan="2">PCU's address</th><th colspan="3">Contents</th><th rowspan="2">Setting</th></tr>
<tr><th>Bits 08 to 15</th><th colspan="2">Bits 00 to 07</th></tr>
<tr><td>1856 hex</td><td>Transfer cycle</td><td colspan="2">Communications cycle</td><td>Transfer cycle:
00 hex: 1 ms (default setting)
01 hex: 1 ms 05 hex: 5 ms
02 hex: 2 ms 06 hex: 6 ms
03 hex: 3 ms 07 hex: 7 ms
04 hex: 4 ms 08 hex: 8 ms
A2 hex: 0.25 ms A5 hex: 0.5 ms
Communications cycle:
Sets a multiplier to obtain integer multiples of the transfer cycle.
Set value: 00 to 20 hex
The default setting 00 is the same as when the cycle is set to 3.
Set as follows:
G Series
Transfer cycle × communications cycle (multiplier) ≤ 16 ms.
Other Series
Transfer cycle × communications cycle (multiplier) ≤ 32 ms
The transfer cycle must be between 1 and 4 ms.</td></tr>
<tr><td rowspan="2">1857 hex</td><td rowspan="2">00 (fixed)</td><td>07 to 04</td><td>03 to 00</td><td rowspan="2">C2 master connection:
0: No C2 master (default setting)
1: C2 master connected
Number of communications retries:
Set value: 0 to 7, F
The default setting 0 is the same as when the number of retries is set to 1.
When F is specified, the number of retries is 0 (no retries).</td></tr>
<tr><td>C2 master connection</td><td>Number of communications retries</td></tr>
</table>

Transfer Cycle

The transfer cycle is the cycle used for sending and receiving data with MECHATROLINK communications. Data (sent and received) is constantly exchanged along the MECHATROLINK communications path during every transfer cycle. The set value and setting range for the transfer cycle depends on the type and number of MECHATROLINK devices connected. When a W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module or with built-in MECHATROLINK-II communications is connected to the PCU, the setting range for the transfer cycle is 0.5 to 4 ms. When a G-series Servo Drive is connected to the PCU, the setting range for the transfer cycle is 1 to 4 ms.

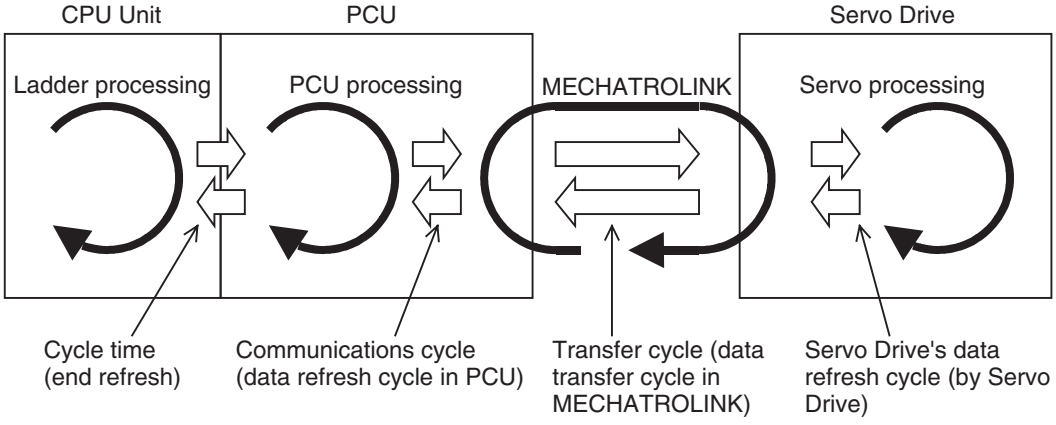
Communications Cycle

The communications cycle is the cycle used to refresh data in the PCU and MECHATROLINK devices. The PCU sends operating commands to the connected MECHATROLINK devices and refreshes present positions, status, and other monitoring information every communications cycle.

The set value for the PCU's communications cycle is an integer used as a multiplier to obtain integer multiples of the transfer cycle. The actual communications cycle (data refresh cycle) is a time cycle that is a multiple of the transfer cycle's set value. The set value for the communications cycle is determined by the number of connected MECHATROLINK devices and depends on the PCU communications processing.

The actual communications cycle (data refresh cycle) is a time cycle calculated by multiplying the transfer cycle by a set value. The lower limit of the communications cycle is determined by the number of connected MECHATROLINK devices and depends on the PCU communications processing. When the default setting of 0 is used, the communications cycle is three times the length of the transfer cycle. Set the communications cycle so that the maximum value does not exceed 32 ms. When connecting a G-series Servo Drive, set the communications cycle so that the maximum value does not exceed 16 ms.

The following diagram illustrates data exchange with the PCU.



Number of Communications Retries

The number of communications retries is the number of stations that will perform retries if data sending/receiving fails when transferring data that is exchanged between the PCU and MECHATROLINK devices using the transfer cycle. The set value is set as the maximum number of stations used to retry data transmission with the slave station for which data sending/receiving failed.

The number of communications retries can be set between 0 and 7 (communications retries for up to 7 stations). The set value for the number of retries, however, is added to the number of connected stations that determine the transfer cycle (e.g., for 3 retries, the transfer cycle must be considered as that for the number of stations connected plus 3). For normal use, use the default setting of 0 (1 communications retry).

C2 Master Connection

The C2 master is a separate communications master connected to the PCU for MECHATROLINK system support. This setting will be used when a future system support device is connected. Use the default setting 0 (No C2 master).

Setting the Transfer Cycle and Communications Cycle

The transfer cycle and communications cycle are set as Common Parameters in the PCU. Set the PCU's transfer cycle and communications cycle according to the number of connected MECHATROLINK devices so that the set values are not lower than the values shown in the following table.

Note Make sure that all of the axis number settings (station numbers of the MECHATROLINK devices) are set to values equal to or less than the number of connected devices for the transfer cycle. Here, the number of connected MECHATROLINK devices is not the actual number of MECHATROLINK devices connected, but the highest registered axis number. For example, when using MECHATROLINK devices for axis number 9 or higher, the transfer cycle must be at least 2 ms even if less than nine devices are connected. If the set value for the transfer cycle is smaller than the number of connected devices or the axis number settings, a Transfer Cycle Setting Error (Unit error code: 0027) will occur when CONNECT is executed.

For the communications cycle, set the multiplier of the transfer cycle set value so that the value is not lower than the values shown in the following table.

For example, if up to 3 Servo Drives (axis number 1 to 3) equipped with JUSP-NS115 MECHATROLINK-II Application Modules are connected to the PCU, either set the transfer cycle to 0.5 ms min. and the communications cycle set value to 2 (multiplier) or higher, or set the transfer cycle to 1.0 ms min. and the communications cycle set value to 1 (multiplier) or higher.

Number of devices connected	R88D-GN□-ML2 G-series Servo Drive equipped with built-in MECHATROLINK-II communications		R88D-WT□ W-series Servo Drive equipped with JUSP-NS115 MECHATROLINK-II Application Module		R88D-WN□-ML2 W-series Servo Drive equipped with built-in MECHATROLINK-II communications		R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive equipped with built-in MECHATROLINK-II communications	
	Minimum transfer cycle set value	Minimum communications cycle value	Minimum transfer cycle set value	Minimum communications cycle value	Minimum transfer cycle set value	Minimum communications cycle value	Minimum transfer cycle set value	Minimum communications cycle value
1	1.0 ms	1.0 ms (1)	0.5 ms	1.0 ms (2)	0.5 ms	0.5 ms (1)	1.0 ms	1.0 ms (1)
2	1.0 ms	1.0 ms (1)	0.5 ms	1.0 ms (2)	0.5 ms	1.0 ms (2)	1.0 ms	1.0 ms (1)
3	1.0 ms	1.0 ms (1)	0.5 ms	1.0 ms (2)	0.5 ms	1.0 ms (2)	1.0 ms	1.0 ms (1)
4	1.0 ms	1.0 ms (1)	1.0 ms	1.0 ms (1)	1.0 ms	1.0 ms (1)	1.0 ms	1.0 ms (1)
5	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)
6	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)
7	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)
8	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)	1.0 ms	2.0 ms (2)
9	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)
10	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)	2.0 ms	2.0 ms (1)
11	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)
12	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)
13	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)
14	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)
15	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)
16	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)	2.0 ms	4.0 ms (2)

Note (1) The set values in the above table apply when the default settings are used for the number of communications retries (once) and C2 master connection (No C2 master).

(2) The values in parentheses in the *Minimum communications cycle value* column are the PCU's communications cycle set value (multiplier to obtain integer multiples of the transfer cycle) used to set the minimum communications cycle for the minimum transfer cycle set value.

(3) When using the R88D-WT□ W-series Servo Drive and JUSP-NS115 together, the SMARTSTEP Junior, or the R88D_GN□, set the communications cycle so that it is an integer multiple of 1.0 ms. When using the R88D-WN□-ML2 W-series Servo Drive, set the communications cycle so that it is an integer multiple of 0.5 ms.

(4) When connecting a G-series Servo Drive, W-series Servo Drive, or the SMARTSTEP Junior Servo Drive to the PCU, set the transfer cycle to 4 ms max.

The PCU default settings are 1.0 ms for the transfer cycle and 3 for the communications cycle (multiplier 3: 1.0 ms × 3 = 3.0 ms). Without changing the default settings, the G-series Servo Drive, W-series Servo Drive (equipped with JUSP-NS115 MECHATROLINK-II Application Module or built-in MECHATROLINK-II communications), or the SMARTSTEP Junior Servo Drive can be used for up to eight axes (axis numbers 1 to 8).

Note

(1) When using linear interpolation, set the communications cycle to a value 1 ms higher than the minimum value given in the above table. If the communications cycle setting is too small, the command response time of the Position Control Unit function may be greatly extended.

(2) The command response time for axes not used for linear interpolation will be increased by up to four communications cycles per linear interpolation combination being executed. This applies from when setting the linear interpolation operation is started until linear interpolation is completed (i.e., while either the SETTING LINEAR INTERPOLATION Bit or the Linear Interpolation Executing Flag is ON).

Transfer Cycle and Communications Cycle When Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation with Position Control Units with Unit Ver. 2.0

Make the settings according to the following table when using a Position Control Unit with unit version 2.0. For a Position Control Unit with unit version 2.1 or later, the same settings can be used for the communications cycle as when not setting the absolute encoder zero point position offset using an origin search operation.

If an absolute encoder zero point position offset is set using an origin search operation for a motor with an absolute encoder, set the transfer cycle and communications cycle according to the following table. The settings will depend on the number of axes used and other functions that are executed simultaneously. Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details on the position offset setting.

If the settings of the transfer cycle and communications cycle are smaller than the values given in the following table when the absolute encoder zero point position offset is set using an origin search operation, the offset may not be calculated correctly and the position of the origin may not be correct.

Number of devices connected	Min. set values when setting the absolute encoder zero point position offset using an origin search						
	Linear interpolation not performed at the same time		Linear interpolation performed at the same time for one set of axes		Linear interpolation performed at the same time for two sets of axes		During online monitoring with the CX-Motion-NCF
	Minimum transfer cycle set value	Minimum communications cycle value	Minimum transfer cycle set value	Minimum communications cycle value	Minimum transfer cycle set value	Minimum communications cycle value	
1	0.5 ms	1.0 ms (2)	0.5 ms	3.0 ms (6)	---	---	Communications cycle time on the left + 1.0 ms
2	0.5 ms	1.0 ms (2)	0.5 ms	4.0 ms (8)	---	---	
3	0.5 ms	2.0 ms (4)	0.5 ms	5.0 ms (10)	---	---	
4	1.0 ms	2.0 ms (2)	1.0 ms	5.0 ms (5)	---	---	
5	1.0 ms	2.0 ms (2)	1.0 ms	6.0 ms (6)	1.0 ms	7.0 ms (7)	
6	1.0 ms	3.0 ms (3)	1.0 ms	6.0 ms (6)	1.0 ms	8.0 ms (8)	
7	1.0 ms	3.0 ms (3)	1.0 ms	6.0 ms (6)	1.0 ms	9.0 ms (9)	
8	1.0 ms	3.0 ms (3)	1.0 ms	7.0 ms (7)	1.0 ms	10.0 ms (10)	
9	2.0 ms	4.0 ms (2)	2.0 ms	8.0 ms (4)	2.0 ms	12.0 ms (6)	Same as on the left
10	2.0 ms	4.0 ms (2)	2.0 ms	8.0 ms (4)	2.0 ms	12.0 ms (6)	Communications cycle time on the left + 2.0 ms
11	2.0 ms	4.0 ms (2)	2.0 ms	8.0 ms (4)	2.0 ms	12.0 ms (6)	
12	2.0 ms	4.0 ms (2)	2.0 ms	8.0 ms (4)	2.0 ms	12.0 ms (6)	
13	2.0 ms	6.0 ms (3)	2.0 ms	8.0 ms (4)	2.0 ms	12.0 ms (6)	
14	2.0 ms	6.0 ms (3)	2.0 ms	10.0 ms (5)	2.0 ms	12.0 ms (6)	
15	2.0 ms	6.0 ms (3)	2.0 ms	10.0 ms (5)	2.0 ms	12.0 ms (6)	
16	2.0 ms	6.0 ms (3)	2.0 ms	10.0 ms (5)	2.0 ms	14.0 ms (7)	Same as on the left

Note

(1) The values in parentheses in the *Minimum communications cycle value* column are the PCU's communications cycle set value (multiplier to obtain integer multiples of the transfer cycle) used to set the minimum communications cycle for the minimum transfer cycle set value.

(2) The above table gives values for when an absolute encoder zero point position offset is set using an origin search operation when a Position Control Unit of unit version 2.0 is used. If this function is not being used, set the transfer cycle and communications cycle based on the table on page 229.

(3) The communications cycle values shown in the above table are the set values for W-series Servo Drives. The minimum communications cycle values for G-series Servo Drives are the same as those indicated in the table above, but refer to the table on page 229 for the minimum transfer cycles.

(4) The settings of the transfer cycle and communications cycle have a large effect on the PCU's command response time. (Refer to *Command Response Time* in *Appendix A Performance Characteristics.*) As shown in the above table, the communications cycle (time) must be increased, e.g., particularly when linear interpolation is used at the same time as an origin search is used to set the absolute encoder zero point position offset (for different axes). The affect on system performance must thus be considered when making the settings. If it is not possible to increase the communications cycle, provide an interlock circuit between the operation of different axes so that linear interpolation is not performed for one axis

while an origin search is being performed for a motor with an absolute encoder on another axis.

6-3 MECHATROLINK Communications Control

MECHATROLINK communications control used for the PCU is described here.

6-3-1 Establishing Connections

Establishing a connection refers to starting communications between the PCU and the MECHATROLINK devices registered in the scan list. Connections are established by turning ON the CONNECT Bit in the Common Operating Output Memory Area. When CONNECT is executed, the PCU executes ERROR RESET (UNIT ERROR RESET or AXIS ERROR RESET) for the PCU itself and all the axes registered in the scan list.

For any error that occurs in an axis, ERROR RESET is executed when the connection with the corresponding axis is established. Therefore, if the cause of an error is removed, unless an error occurs due to connection processing, the PCU will start MECHATROLINK communications with all errors reset when CONNECT is executed.

The PCU status is initialized when a connection is established, as follows:

- PCU Positioning Completed Flag OFF
- Origin not established (No Origin Flag ON)

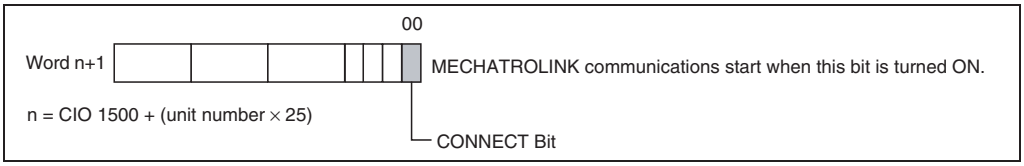
  When using Servomotors with absolute encoders for which the encoder type is set to absolute encoder in the axis parameters, however, the origin is established (No Origin Flag OFF) by reading the absolute value data when the connection is established.
- Stop Execution Flag OFF

For details on errors when establishing connections, refer to *6-3-3 MECHATROLINK Communications Errors*. The CONNECT Bit is allocated in CIO 1501 + (unit number × 25), bit 00.

Common Operating Memory Area (Output)

Name	Word	Bits	Contents
CONNECT Bit	n+1	00	0 → 1: Establishes connection. 1 → 0: Releases connection.

n = CIO 1500 + (unit number × 25)



If the CONNECT Bit is turned OFF while a connection is established, the PCU will stop MECHATROLINK communications (connection released).

When a connection is released, the active axis is put in the Servo free run state.

For all axes registered in the scan list, the status that is input in the Axis Operating Input Memory Areas for each axis becomes the initial status (non-executing status), except for the Error Flag and axis error code. For example, the No Origin Flag turns ON because the origin is not established.

Note When a connection is released, the PCU immediately stops controlling the active axes. If a connection is released while another command is being processed, the Servo Drive may not respond to the command properly. Make sure that command processing has been completed (Busy Flag = 0 and Servo Parameter Transferring Flag = 0) before releasing a connection. When a connection is reestablished after recovering from an error that caused the PCU to release a connection, confirm that the settings and operating status of the Servo Drive are correct before restarting operations. (If necessary, transfer the Servo parameters again and execute DEVICE SETUP.)

6-3-2 MECHATROLINK Communications Status

The MECHATROLINK communications status is given using the following two status flags allocated in the Common Operating Input Memory Area of the PCU.

- Connection Status Flag
- Axis Communications Status Flags

Connection Status Flag

This status flag turns ON when the PCU has established a connection (MECHATROLINK communications have started).

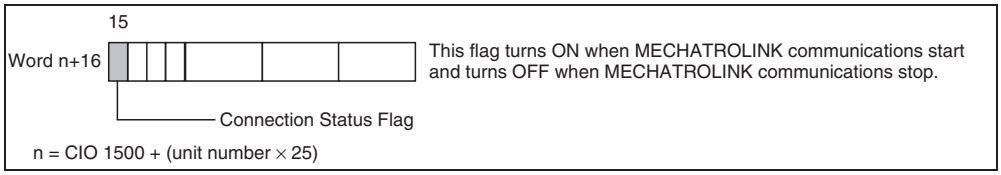
The PCU starts MECHATROLINK communications for the axes registered in the scan list. This status flag will turn ON, however, when CONNECT is executed, even if nothing is registered in the scan list.

The Connection Status Flag turns OFF when the connection is released. The Connection Status Flag is allocated in CIO 1516 + (unit number × 25), bit 15.

Common Operating Memory Area (Input)

Name	Word	Bits	Contents
Connection Status Flag	n+16	15	0: MECHATROLINK communications stopped. 1: MECHATROLINK communications executing.

n = CIO 1500 + (unit number × 25)


15
Word n+16
This flag turns ON when MECHATROLINK communications start and turns OFF when MECHATROLINK communications stop.
Connection Status Flag
n = CIO 1500 + (unit number × 25)

Axis Communications Status Flags

These status flags turn ON when a connection has been established between the PCU and the MECHATROLINK devices connected to the PCU. The Axis Communications Status Flags are allocated in one word with 16 bits, with one bit assigned to each of the 16 axes showing the corresponding communications status.

The PCU connects the axes registered in the scan list to MECHATROLINK communications, recognizing those axes and monitoring their communications. Therefore, the Axis Communications Status Flags for axes not registered in the scan list are always OFF.

The operation of the Axis Communications Status Flag depends on the unit version of the PCU as shown in the following table

Unit version	Setting conditions	Resetting conditions
Unit version 1.3 or earlier	• The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start.	• The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list. • The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected. • The flags will turn OFF if a Unit error occurs that requires disconnection.
Unit version 2.0 or later	• The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start. • The flags will turn ON when the rejoin function is used to start MECHATROLINK communications for an axis registered in the scan list.	• The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list. • The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected. • The flags will turn OFF if a Unit error occurs that requires disconnection. • The flags will turn OFF whenever a communications error occurs after MECHATROLINK communications have been started for the axis.

With unit version 1.3 or earlier, once MECHATROLINK communications have been started by establishing connections, the Axis Communications Status Flags will not change unless communications are disconnected (including Unit errors that required disconnection).

With unit version 2.0 or later, the Axis Communications Status Flags will turn OFF after connections have been established whenever axis operation becomes impossible due to a communications error (synchronous communications alarm or communications alarm).

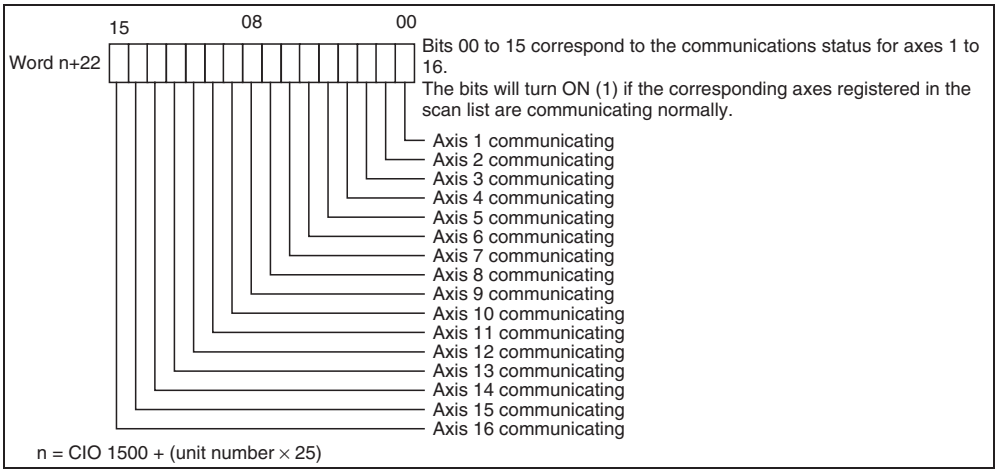
Refer to *6-3-3 MECHATROLINK Communications Errors* for information on errors that occur when establishing connections.

The Axis Communications Status Flags are allocated in CIO 1522 + (unit number × 25).

Common Operating Memory Area (Input)

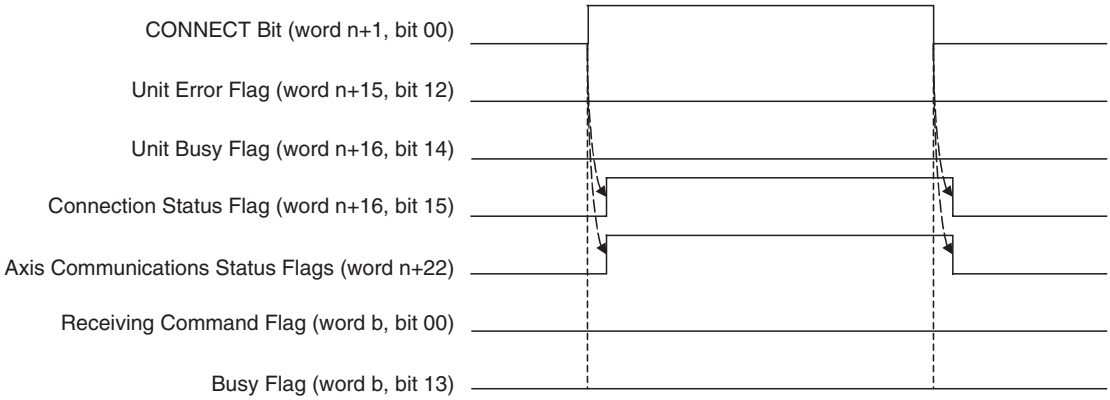
Name	Word	Bits	Contents
Axis Communications Status Flags	n+22	00	0: Axis 1 communications stopped, or axis not registered in scan list. 1: Axis 1 communications executing.
		01	Same as above for axis 2.
		02	Same as above for axis 3.
		03	Same as above for axis 4.
		04	Same as above for axis 5.
		05	Same as above for axis 6.
		06	Same as above for axis 7.
		07	Same as above for axis 8.
		08	Same as above for axis 9.
		09	Same as above for axis 10.
		10	Same as above for axis 11.
		11	Same as above for axis 12.
		12	Same as above for axis 13.
		13	Same as above for axis 14.
		14	Same as above for axis 15.
		15	Same as above for axis 16.

n = CIO 1500 + (unit number × 25)


15
08
00
Word n+22
Bits 00 to 15 correspond to the communications status for axes 1 to 16.
The bits will turn ON (1) if the corresponding axes registered in the scan list are communicating normally.
Axis 1 communicating
Axis 2 communicating
Axis 3 communicating
Axis 4 communicating
Axis 5 communicating
Axis 6 communicating
Axis 7 communicating
Axis 8 communicating
Axis 9 communicating
Axis 10 communicating
Axis 11 communicating
Axis 12 communicating
Axis 13 communicating
Axis 14 communicating
Axis 15 communicating
Axis 16 communicating
n = CIO 1500 + (unit number × 25)

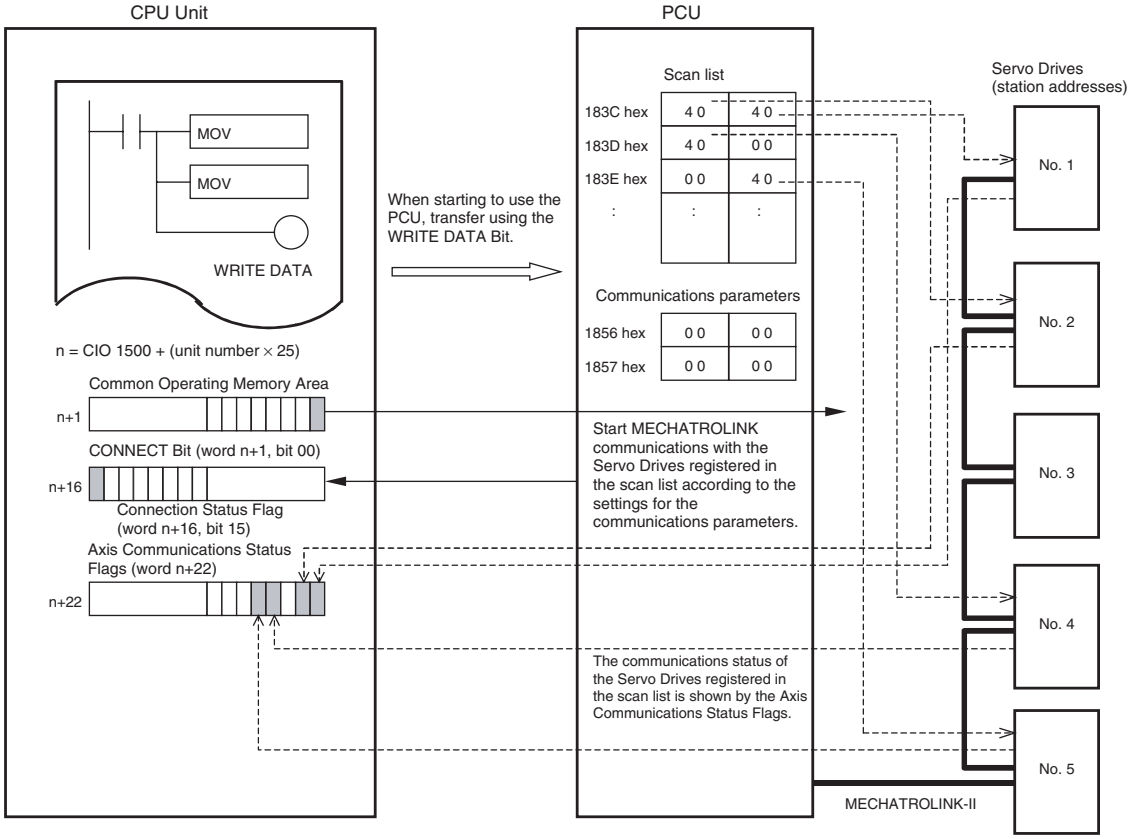
Timing Chart

The following diagram shows the timing chart for establishing and releasing a connection.


CONNECT Bit (word n+1, bit 00)
Unit Error Flag (word n+15, bit 12)
Unit Busy Flag (word n+16, bit 14)
Connection Status Flag (word n+16, bit 15)
Axis Communications Status Flags (word n+22)
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)

When the PCU starts MECHATROLINK communications as a result of the CONNECT Bit turning ON, the Connection Status Flag turns ON. The Axis Communications Status Flags turn ON when the connection is established for axes registered in the scan list only.
There is no change in status of the Unit Busy Flag, or the Receiving Command Flags or Busy Flags for the connected axes when a connection is established or released.

n = CIO 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25


CPU Unit
PCU
MOV
MOV
WRITE DATA
When starting to use the PCU, transfer using the WRITE DATA Bit.
Scan list
183C hex
183D hex
183E hex
Communications parameters
1856 hex
1857 hex
Servo Drives (station addresses)
No. 1
No. 2
No. 3
No. 4
No. 5
n = CIO 1500 + (unit number × 25)
Common Operating Memory Area
n+1
CONNECT Bit (word n+1, bit 00)
n+16
Connection Status Flag (word n+16, bit 15)
Axis Communications Status Flags (word n+22)
n+22
Start MECHATROLINK communications with the Servo Drives registered in the scan list according to the settings for the communications parameters.
The communications status of the Servo Drives registered in the scan list is shown by the Axis Communications Status Flags.
MECHATROLINK-II

In the above example, Servo Drives are registered to axes 1, 2, 4, and 5 in the scan list (set to 40 hex). Therefore, MECHATROLINK communications start with the Servo Drives with station addresses No. 1, No. 2, No. 4, and No. 5 when CONNECT is executed.

Restrictions in Establishing a Connection According to Servo Drive Status

Functionality for axis operations after establishing a connection depends on the unit version of the PCU as described below if the following conditions exist when a connection is established for an axis (Servo Drive) registered in the scan list.

- Disconnection
- Control power supply interruption
- An alarm that cannot be reset (i.e., when the power must be cycled)

■ PCUs with Unit Version 1.2 or Earlier

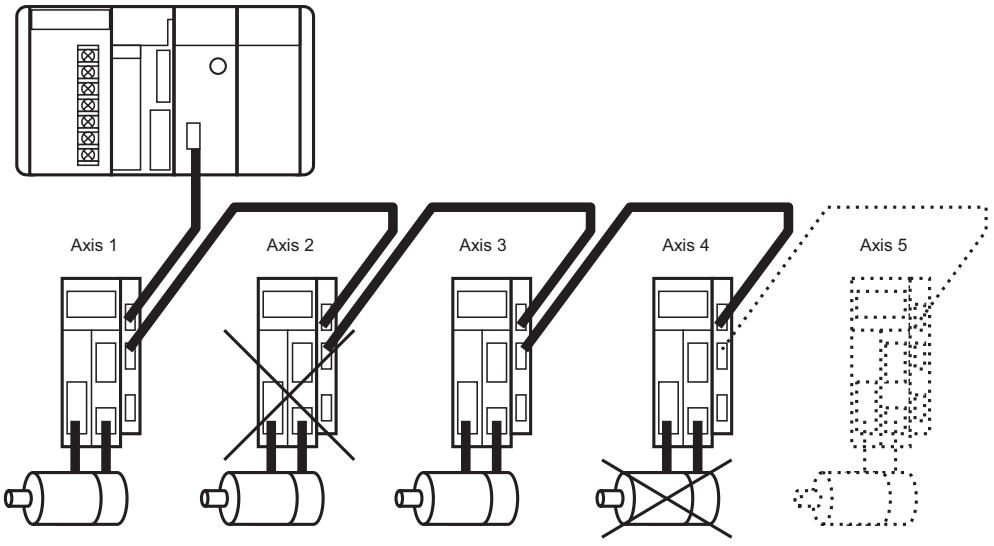
An MLK initialization error (unit error code 0020 hex) will occur in these situations, and operation for MECHATROLINK communications will stop for all axes. To start MECHATROLINK communications normally, any errors must be cleared for all axes registered in the scan list before establishing a connection.

■ PCUs with Unit Version 1.3 or Later

Axis operation is possible for axes that are registered in the scan list and for which MECHATROLINK communications was started (i.e., axes for which Axis Communications Status Flags are ON), regardless of whether an alarm is present in the Servo Drive or whether the connected axes match the scan list. If MECHATROLINK communications cannot be started for all axes registered in the scan list, an MLK initialization error (unit error code 0020 hex) will occur to provide notification of the inconsistency between the registered axes and the axes that are communicating.

The following example shows the restrictions in operations according to axis status when connections are established.

Example: When Axes 1 to 5 Are Registered in the Scan List



Axis No.	No. 1	No. 2	No. 3	No. 4	No. 5
Axis status (example) Function	Normal	Control power supply interrupted (See note 1.)	Normal	Alarm that cannot be reset (See note 2.)	Disconnection
Connection	Possible	Not possible	Possible	Possible	Not possible
Axis Communications Status Flag	ON	OFF	ON	ON	OFF
Monitoring (including error codes)	Possible	Not possible	Possible	Possible	Not possible

Axis No.	No. 1	No. 2	No. 3	No. 4	No. 5
Servo parameter transfer	Possible	Not possible	Possible	Possible	Not possible
Axis operating commands	Possible	Not possible	Possible	Not possible	Not possible

Note (1) It is assumed that the MECHATROLINK communications cable is connected.

(2) For example, when A.81 (backup error) occurs. MECHATROLINK communications may not be possible, depending on the individual Servo Drive specifications and on the type of alarm that cannot be reset.

For axes 1 and 3, MECHATROLINK communications can be started and all axis operations can be executed if there is no Servo Drive error. For axis 2 (with no control power supply) and axis 5 (disconnected), MECHATROLINK communications cannot be started, and operations and monitoring are not possible. If MECHATROLINK communications can be started for axis 4 (alarm that cannot be reset), depending on the handling of the Servo Drive error, the axis can be monitored and parameters can be transferred but axis operations cannot be executed. In this example, the axes for which MECHATROLINK communications can actually be started are 1, 3, and 4. This does not match the axes registered in the scan list (i.e., axes 1 to 5), so an MLK initialization error (unit error code 0020 hex) occurs.

6-3-3 MECHATROLINK Communications Errors

The PCU monitors and detects errors if they occur at the start of or during MECHATROLINK communications. Detected errors are largely categorized as PCU common errors that stop MECHATROLINK communications and operation of all axes, and axis errors that stop individual axes. Moreover, they are classified into three types of error: Errors at Communications Startup, Errors Detected by PCU during Communications, and Errors Detected in MECHATROLINK Slave Stations Connected to PCU during Communications.

Errors that Stop MECHATROLINK Communications (Unit Common Errors)

Errors at Communications Startup

The following errors in MECHATROLINK (MLK) communications are monitored by the PCU when CONNECT is executed.

Errors in MECHATROLINK slave station devices cannot be detected by the PCU before a connection is established. The PCU will execute ALARM RESET for the devices communicating with MECHATROLINK when a connection is established.

MLK Device Initialization Error (Unit Error Code: 0030 Hex)

This error occurs if initialization of MECHATROLINK communications fails when CONNECT is executed, and causes connection processing to stop. When this error occurs, confirm that the PCU's common parameters and MECHATROLINK communications settings are set correctly, restart the PCU, and then execute CONNECT again. If the error occurs again, it is a result of an error in the MECHATROLINK communications section of the PCU and requires replacement of the PCU.

MLK Initialization Error (Unit Error Code: 0020 Hex)

This error occurs if the MECHATROLINK slave station device corresponding to the axis number registered in the scan list is not detected within 10 seconds after CONNECT is executed. This error may occur if a MECHATROLINK slave station communications settings are not set, or if the settings for the MECHATROLINK communications line connection and slave device's station address do not match the settings in the scan list. Verify that the contents registered in the scan list matches the MECHATROLINK device settings and connection configuration.

If this error occurs, the PCU will stop and the connection status will remain ON (communications still in an executing state).

For PCUs with unit version 1.2 or earlier, operation will not be possible for all axes registered in the scan list. For PCUs with unit version 1.3 or later, all or part of the axis operations will be possible assuming that MECHATROLINK communications can be established (i.e., if the Axis Communications Status Flag is ON). (Refer to *6-3-2 MECHATROLINK Communications Status* for axis operation restrictions according to Servo Drive status.)

After recovering from the error, release the connection and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

MLK Communications Error (Unit Error Code: 0025 Hex)

This error occurs if two or more connected MECHATROLINK slave station devices have the same station number when CONNECT is executed. This error also occurs when communications errors that are not specific to a particular slave station occur during MECHATROLINK communications, and causes MECHATROLINK communications to stop (connection released). This error may occur during MECHATROLINK communications as a result of a faulty communications path such as noise, breaks, or faulty connections in the communications line. After removing the cause of the error, restart the PCU and execute CONNECT again.

MLK Device Error (Unit Error Code: 0026 Hex)

This error occurs if an error in the MECHATROLINK communications section of the PCU is detected, and causes MECHATROLINK communications to stop (connection released). This error will occur if the MECHATROLINK communications section of the PCU is faulty. Replace the PCU if this error occurs.

Transfer Cycle Setting Error (Unit Error Code: 0027 Hex)

This error may occur when establishing a connection if the transfer cycle set in the PCU's Common Parameters is unsuitable for the axis numbers or number of slave stations connected to MECHATROLINK, and causes MECHATROLINK communications to stop (connection released). This error indicates that the set value for the transfer cycle is too small for the axis numbers or number of connected slave stations. Change the transfer cycle setting in the Common Parameters. After removing the cause of the error, restart the PCU and execute CONNECT again.

If a Unit common error occurs, the Unit Error Flag in the Common Operating Memory Area of the PCU turns ON, and the corresponding error code is input in the Unit Error Code Bits. After the cause of the error is removed, the Unit common error is cleared by turning ON the UNIT ERROR RESET Bit in the Common Operating Memory Area.

When clearing a Unit common error, make sure that the UNIT ERROR RESET Bit will remain ON until the Unit Busy Flag turns ON.

The UNIT ERROR RESET Bit cannot be used to clear errors that require PCU replacement (MLK Device Initialization Error or MLK Device Error), or that cause MECHATROLINK communications to stop (MLK Communications Error or Transfer Cycle Setting Error). After removing the cause of the error, turn ON the power to the PLC again or restart the PCU.

Common Operating Memory Area (Output)

Name	Word	Bits	Contents
UNIT ERROR RESET Bit	n	00	0 → 1: Clears the Unit common error that occurred.

n = CIO 1500 + (unit number × 25)

Common Operating Memory Area (Input)

Name	Word	Bits	Contents
Unit Error Flag	n+15	12	0: Unit common error has not occurred. 1: Unit common error has occurred.
Unit Busy Flag	n+16	14	0: PCU is not busy. 1: PCU is busy.
Connection Status Flag		15	0: MECHATROLINK communications stopped. 1: MECHATROLINK communications executing.
Unit error code	n+21	00 to 15	Indicates the error code for the common Unit error that occurred.

n = CIO 1500 + (unit number × 25)

Individual Axis Errors

Errors Detected by PCU during Communications

Synchronous Communications Alarm (Axis Error Code: 3010 Hex)

This error occurs for errors in synchronous MECHATROLINK communications processing with an axis.

If this error occurs, the corresponding axis will stop operating according to the stop method that is set in the Servo Drive for when alarms occur.

This error may occur as a result of a faulty communications path with the corresponding axis, such as noise, breaks, or faulty connections in the communications line.

If this error occurs, the corresponding axis may not be able to accept operations through MECHATROLINK communications such as ERROR RESET. To recover from this error, release the connection and remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

Communications Alarm (Axis Error Code: 3011 Hex)

This error occurs for errors in MECHATROLINK communications processing with an axis. The communications alarm will occur if the PCU fails twice in succession to exchange data using MECHATROLINK communications, such as not receiving communications data. The corresponding axis will stop operating if this alarm occurs according to the stop method that is set in the Servo Drive for when alarms occur.

This error may occur as a result of a faulty communications path with the corresponding axis, such as noise, breaks, or faulty connections in the communications line.

If this error occurs, the corresponding axis may not be able to accept operations through MECHATROLINK communications such as ERROR RESET. To recover from this error, release the connection, remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

Errors Detected in MECHATROLINK Slave Station Connected to PCU during Communications

Errors detected in the slave stations connected to the PCU via MECHATROLINK after a connection is established cause axis errors or axis warnings in the PCU, as follows:

MLK Device Alarm/Warning (Axis Error Code 40□□ Hex)

The boxes (□□) indicate the alarm number for the connected MECHATROLINK devices. The operations of each axis when an error occurs depend on each of the MECHATROLINK slave station devices.

For errors in MECHATROLINK communications that occur in individual axes, the Error Flags for the corresponding axes turn ON in the Axis Operating Input Memory Areas of the PCU, and the corresponding error code is input in the axis error code word.

After the cause of the error is removed, the axis error is cleared by turning ON the ERROR RESET Bit in the Axis Operating Output Memory Area. When clearing the axis error, make sure that the ERROR RESET Bit will remain ON until the Busy Flag for the corresponding axis turns ON.

The ERROR RESET Bit cannot be used to clear errors such as Synchronous Communications Alarms or Communications Alarms. To recover from these errors, release the connection, remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

Axis Operating Output Memory Areas

Name	Word	Bits	Contents
ERROR RESET Bit	a	12	0 → 1: Clears the axis error that occurred.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Areas

Name	Word	Bits	Contents
Warning Flag	b	11	0: Axis warning has not occurred. 1: Axis warning has occurred.
Error Flag		12	0: Axis error has not occurred. 1: Axis error has occurred.
Busy Flag		13	0: Axis is not busy. 1: Axis is busy.
Axis error code	b+4	00 to 15	Indicates the axis error code/warning code for each axis.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

For details on indicators and troubleshooting for when errors occur in the PCU, refer to *SECTION 12 Troubleshooting*. For details on error displays and troubleshooting for MECHATROLINK slave station devices, refer to the operation manuals for the corresponding device.

Note If an axis warning occurs (Warning Flag = 1), the PCU's command response time is delayed due to the PCU's warning processing. The PCU processing time required after receiving a command from the CPU Unit until the command is sent using MECHATROLINK communications is one MECHATROLINK communications cycle if an axis warning has not occurred, and three MECHATROLINK communications cycles if an axis warning has occurred. If the machine's operation would be affected by the PCU's command response time, clear the axis warning status using ERROR RESET or set the Servo Drive settings so that the warnings will not occur. For details on the PCU's command response time, refer to *Command Response Time* in *Appendix A Performance Characteristics*.

6-3-4 Rejoining the Connection

Overview

The rejoin function can be used to rejoin the connection for an axis for which operations are not possible using MECHATROLINK communications either when initially establishing the connection or after the connection has been established.

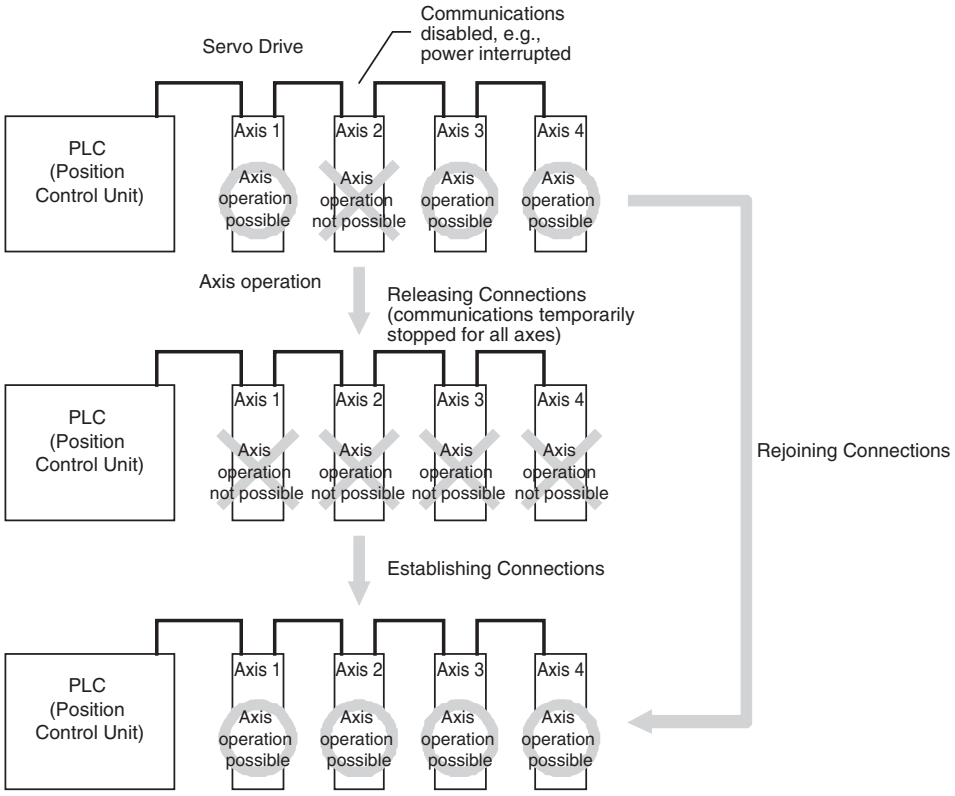
This function can be used only with Position Control Units with unit version 2.0 or later.

If any axis registered in the scan list is in either of the following conditions, the error cannot be cleared with the normal error reset procedure and axis operations will not be possible from the Position Control Unit.

- If an axis cannot be detected and MECHATROLINK communications cannot be started within 10 s after executing the connection command (An MLK initialization error (Unit error code: 0020 (hex)) will occur.)
- If a synchronous communications alarm (axis error code: 3010 (hex)) occurs or a communications alarm (axis error: 3011 (hex)) occurs

To restart communications for the axis for which axis operations are not possible with Position Control Units with unit version 1.3 or earlier, the connection must be broken and MECHATROLINK communications must be stopped for all axes, and then connection must be re-established.

With Position Control Units with unit version 2.0 or later, the rejoin function can be used to restart MECHATROLINK communications for specific axes without stopping MECHATROLINK communications for all axes.



Using the Rejoin Function

The rejoin function is used by turning ON the REJOIN command bit in the Common Operating Output Memory Area of the Position Control Unit.

When the REJOIN command bit is turned ON, the process to start MECHATROLINK communications is performed in the same way as when a connection is established. This can be used to restart communications for any axes registered in the scan list that are not part of the connection or for which axis operations are not possible due to a communications error.

When using the REJOIN command bit, the axis for which rejoin processing is to be performed can be specified in the Axes to Connect parameter. Refer to *6-3-5 Specifying the Axes to Connect* for details on the Axes to Connect parameter.

When rejoining the connection, errors that occur in the Position Control Unit or the axes will be reset.

Functionality for axis operations after rejoining a connection are the same as when establishing the connection.

The REJOIN command bit is bit 15 of CIO 1501+ (unit number × 25). Keep the REJOIN command bit ON until the Unit Busy Flag turns ON.

Common Operating Output Memory Area

Name	Word	Bit	Contents
REJOIN	n+1	15	Rejoining the connection is started when this bit is turned ON.

n = 1500 + (unit number × 25)

Common Operating Input Memory Area

Name	Word	Bit	Contents
Unit Busy Flag	n+16	14	0: PCU is not busy. 1: PCU is busy.
Connection Status Flag		15	0: MECHATROLINK communications stopped. 1: MECHATROLINK communications executing.
Axis Communications Status Flags	n+22	00 to 15	Indicate the communications status for each axis.

n = 1500 + (unit number × 25)

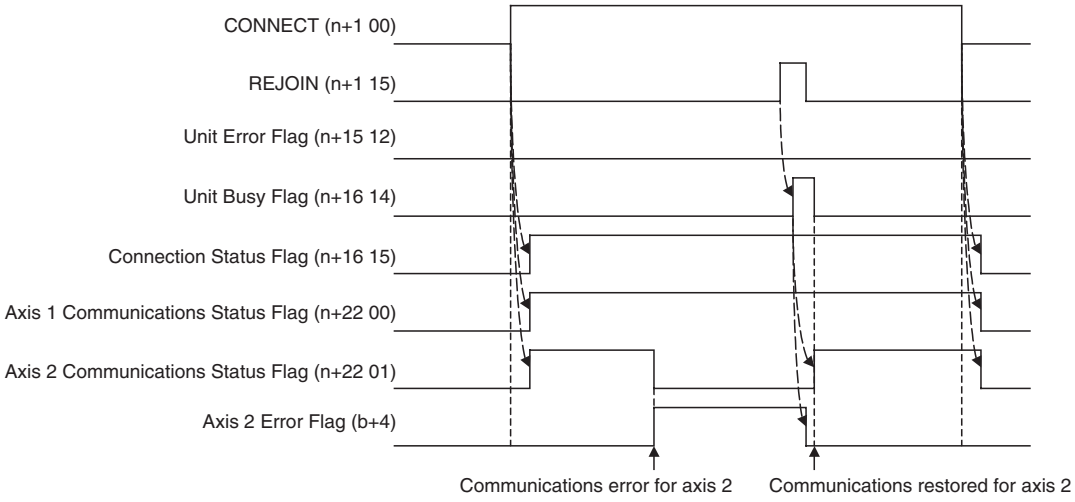
The REJOIN command bit can be used when the Connection Status Flag is ON (i.e., when a connection is established).

When executing processing for an axis to rejoin a connection, the Unit Busy Flag will turn ON for a minimum of one scan time and until the Axis Communications Status Flags turn ON for the axes being processed or until a MLK initialization error (Unit error code: 0020 (hex)) occurs after the REJOIN command bit is turned ON.

Note When the REJOIN command is executed, processing to restart MECHATROLINK communications is performed for all specified axes. If there are any axes for which MECHATROLINK communications cannot be started, communications errors will not occur for individual axes, but rather an MLK initialization error (Unit error code: 0020 (hex)) will occur for the entire Unit. If MECHATROLINK communications cannot be restarted when attempting to recover from communications errors for only specific axes, the error status will thus change from one for specific axes before rejoin processing to one for the entire Unit after rejoin processing. Monitor the status of these error flags to determine the result of rejoin processing.

Timing Chart

A timing chart for rejoin processing is provided below for Position Control Units with unit version 2.0 or later. In this example, axes 1 and 2 are registered in the scan list. After a connection is established, a communications error occurs for axis 2 (i.e., either a sync communications alarm or a communications alarm).


CONNECT (n+1 00)
REJOIN (n+1 15)
Unit Error Flag (n+15 12)
Unit Busy Flag (n+16 14)
Connection Status Flag (n+16 15)
Axis 1 Communications Status Flag (n+22 00)
Axis 2 Communications Status Flag (n+22 01)
Axis 2 Error Flag (b+4)
Communications error for axis 2
Communications restored for axis 2

When a communications error occurs for axis 2, the Axis 2 Error Flag and Axis 2 Communications Status Flag will turn OFF.
After removing the cause of the error, the REJOIN command bit is turned ON to clear the error for axis 2 and restart MECHATROLINK communications. The Axis Communications Status Flag turns ON.

n = CIO 1500 + (unit number × 25)
b = First word specified in the Common Parameters for the Axis Operating Input Memory Area + (Axis No. −1) × 25

6-3-5 Specifying the Axes to Connect

The Axes to Connect parameter can be used to temporarily disable MECHATROLINK communications for one or more axes registered in the scan list. This enables starting MECHATROLINK communications without errors occurring for axes that are not connected without changing the scan list. This can be used, for example, during system design and startup when all axes are not yet connected.

This function can be used only with Position Control Units with unit version 2.0 or later.

The Axes to Connect parameter is in CIO 1502 + (unit number × 25).

Common Operating Output Memory Area

Name	Word	Bit	Contents
Axes to connect	n+2	00	The following settings apply if axis 1 is registered in the scan list: 0: MECHATROLINK communications started for axis 1 1: MECHATROLINK communications not started for axis 1
		01	Same as above for axis 2
		02	Same as above for axis 3
		03	Same as above for axis 4
		04	Same as above for axis 5
		05	Same as above for axis 6
		06	Same as above for axis 7
		07	Same as above for axis 8
		08	Same as above for axis 9
		09	Same as above for axis 10
		10	Same as above for axis 11
		11	Same as above for axis 12
		12	Same as above for axis 13
		13	Same as above for axis 14
		14	Same as above for axis 15
		15	Same as above for axis 16

n = 1500 + (unit number × 25)

The Axes to Connect parameter is valid only when establishing a connection or when rejoining a connection.

Example

This example shows how to use a scan list in which axes 1 to 5 are registered and connect only axes 1, 2, and 5.

- Establishing a Connection for All Axes (n+2 = 0000 (Hex))
  Axes 1, 2, and 5: MECHATROLINK communications started
  Axes 3 and 4: MECHATROLINK communications not started
  In this case, the connection cannot be established for axes 3 and 4, causing an MLK initialization error (Unit error code: 0020 (hex)) to occur in the Position Control Unit.
- Establishing a Connection for All Axes Except Axes 3 and 4 (n+2 = 000C (Hex))
  Axes 1, 2, and 5: MECHATROLINK communications started
  Axes 3 and 4: MECHATROLINK communications not started
  In this case, axes 3 and 4 are treated as if they are not registered in the scan list and an MLK initialization error does not occur in the Position Control Unit.

Note The Axes to Connect parameter is valid only when using the CONNECT or REJOIN command bits in the Common Operating Memory Area. When establishing connections from the CX-Motion-NCF, the Axes to Connect parameter is ignored and processing to start MECHATROLINK communications is performed for all axes registered in the scan list.

If MECHATROLINK communications cannot be started when establishing a connection from the CX-Motion-NCF, an MLK initialization error (Unit error code: 0020 (hex)) regardless of the setting of the Axes to Connect parameter. Provide interlock circuits to allow for this as required by the system.

6-4 Standard Settings for Servo Drives Using MECHATROLINK

6-4-1 G-series Servo Drive Settings (R88D-GN□-ML2 with Built-in MECHATROLINK-II Communications)

When an R88D-GN□-ML2 G-series Servo Drive (with built-in MECHATROLINK-II communications) is used, the default settings for the Servo Drive are the standard settings when the MECHATROLINK communications is used.

Compulsory Parameter Settings

The following Servo Parameter must be set to enable PCU control. Do not change this setting.

Pn005 Communications Control

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn005	Communications control	---	0	0: MECHATROLINK-II communications errors and warnings are all detected.	0

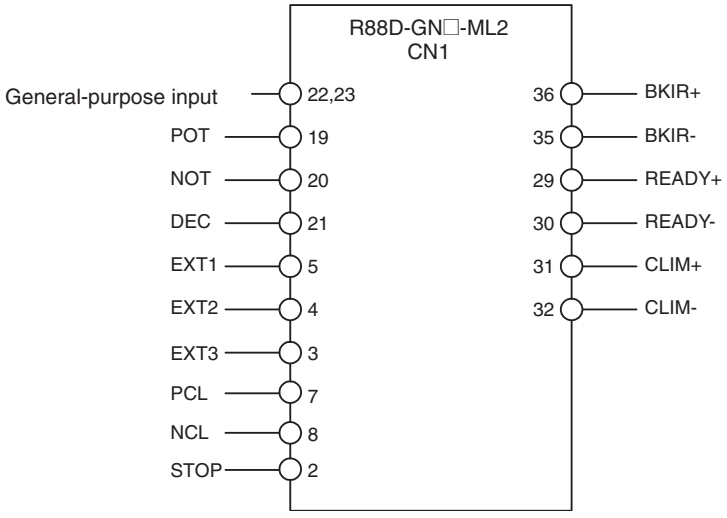
All MECHATROLINK communications errors and warnings are used when the PCU is controlling communications. Set the parameter so that they are all detected. Leave Pn005 set to the default setting.

Standard Settings for I/O Signals Using MECHATROLINK

When an R88D-GN□-ML2 G-series Servo Drive (with built-in MECHATROLINK-II communications) is used, the default settings for the Servo Drive are the standard settings for the I/O signal allocations when the MECHATROLINK communications is used.

The standard input signal settings are used for the PCU's positioning control functions, such as limit inputs, origin searches, and interrupt feeding. Use the default settings for I/O allocations of the Servo Drive.

Standard I/O Signal Allocation



Note The PCU uses the forward drive prohibited input, reverse drive prohibited input, and origin return deceleration limit switch allocated in the Servo Drive's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. The signal widths of these input signals must be longer than the MECHATROLINK communica-

tions cycle. If the input signal width is shorter than the communications cycle, the PCU will not be able to detect the input signal, and operation will not be performed normally.

6-4-2 W-series Servo Drive Settings (R88D-WT□ Equipped with JUSP-NS115)

When the R88D-WT□ W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module is used, settings for some parameters of the W-series user constants (Servo Parameters) may be limited.

Automatically Set Servo Parameters

By equipping the W-series Servo Drive with the JUSP-NS115, the Servo Parameters in the following table will be automatically changed to the fixed settings and saved when the power to the W-series Servo Drive is turned ON for the first time. These parameters are used by the system as fixed settings and must not be changed. (The default settings are those used for W-series Servo Drives before installing the JUSP-NS115.)

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn004	Reserved by the system.	---	0200	---	0000
Pn200	Position control setting 1	---	0100	---	1011
Pn204	Position command filter time constant 1	×0.01 ms	0	Sets soft start for command.	0
Pn207.1	Position control setting 2 Speed command input switching	---	1	REF used as feed-forward input	0
Pn50A.0	Input signal selection 1 Input signal allocation mode	---	1	User-defined sequence input signal allocation	0
Pn50A.1	Input signal selection 1 RUN signal (RUN command) input terminal allocation	---	8	Always invalid.	0
Pn50A.2	Input signal selection 1 MING (gain reduction) signal input terminal allocation	---	8	Always invalid.	1
Pn50B.1	Input signal selection 2 RESET (alarm reset) signal input terminal allocation	---	8	Always invalid.	4
Pn50C	Input signal selection 3 RDIR (rotation direction command signal) SPD1 (speed selection command 1 signal) SPD2 (speed selection command 2 signal) TVSEL (control mode switching signal)	---	8888	Always invalid.	8888
Pn50D.0	Input signal selection 4 PLOCK (position lock command signal)	---	8	Always invalid.	8
Pn50D.1	Input signal selection 4 IPG (pulse disable signal)	---	8	Always invalid.	8

Compulsory Parameter Settings

The following Servo Parameter must be set to enable PCU control. Do not change this setting.

Pn800.0 Communications Control: MECHATROLINK Communications Check Mask

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn800.0	Communications control MECHATROLINK-II communications check mask	---	0	0: Communications errors (A.E6) and synchronization errors (A.E5) both detected.	0

The MECHATROLINK communications errors A.E6 (communications errors) and A.E5 (synchronization errors) are used when the PCU is controlling communications. Make sure to set this parameter so that these errors are always detected. Leave Pn800.0 set to the default setting 0 (detects communications errors (A.E6) and synchronization errors (A.E5)).

Pn800.1 Communications Control: Warning Check Mask

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn800.1	Communications control Warning check mask	---	4 or 0	4: Communications warning (A.96) ignored. 0: A.94, A.95, and A.96 all detected.	4

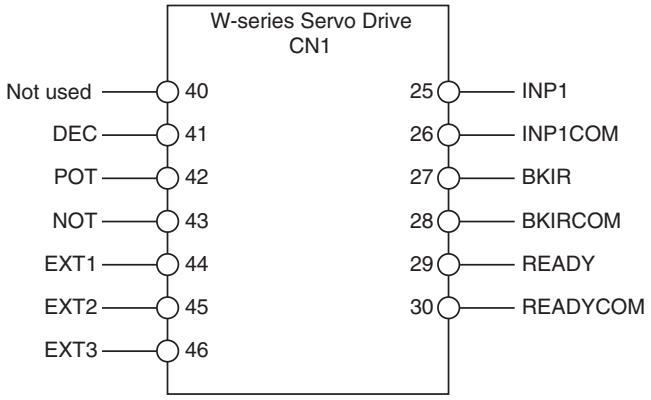
The MECHATROLINK communications warnings A.94 (parameter setting warning) and A.95 (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96) only) or set to 0 (detects A.94, A.95, and A.96).

Standard Settings for I/O Signals Using MECHATROLINK

When MECHATROLINK communications are used by a W-series Servo Drive equipped with JUSP-NS115, the standard settings for the Servo Drive's external I/O signal allocations are as follows:

The standard input signal settings are used for the PCU's positioning control functions such as limit inputs, origin searches, and interrupt feeding. When using a system configuration combining a W-series Servo Drive and JUSP-NS115, use the standard settings for the I/O signal allocations. (The following default settings are those used by W-series Servo Drives before installing the JUSP-NS115.)

I/O Signal Allocations (Standard Settings)



Parameter No.	Parameter name	Standard setting	Details	Default setting
Pn50A.3	Input signal selection 1 POT (forward drive prohibited input) signal input terminal allocation	2	Allocated to CN1, pin 42 Valid for low input (N.C. contact)	8
Pn50B.0	Input signal selection 2 NOT (reverse drive prohibited input) signal input terminal allocation	3	Allocated to CN1, pin 43 Valid for low input (N.C. contact)	8
Pn50B.2	Input signal selection 2 PCL (forward rotation current limit) signal input terminal allocation	8	Always invalid.	5

Parameter No.	Parameter name	Standard setting	Details	Default setting
Pn50B.3	Input signal selection 2 NCL (reverse rotation current limit) signal input terminal allocation	8	Always invalid.	6
Pn511.0	Input signal selection 5 DEC (origin return deceleration limit switch) signal input terminal allocation	1	Allocated to CN1, pin 41 Valid for low input (N.O. contact)	8
Pn511.1	Input signal selection 5 EXT1 (external latch 1 input) signal input terminal allocation	4	Allocated to CN1, pin 44 Valid for low input (N.O. contact)	8
Pn511.2	Input signal selection 5 EXT2 (external latch 2 input) signal input terminal allocation	5	Allocated to CN1, pin 45 Valid for low input (N.O. contact)	8
Pn511.3	Input signal selection 5 EXT3 (external latch 3 input) signal input terminal allocation	6	Allocated to CN1, pin 46 Valid for low input (N.O. contact)	8
Pn50E.0	Output signal selection 1 INP1 (positioning completed 1) signal output terminal allocation	1	Allocated to CN1, pins 25 and 26	1
Pn50E.1	Output signal selection 1 VCMP (speed conformity) signal output terminal allocation	0	No output	1
Pn50E.2	Output signal selection 1 TGON (Servomotor rotation detection) signal output terminal allocation	0	No output	2
Pn50E.3	Output signal selection 1 READY (Servomotor warmup complete) signal output terminal allocation	3	Allocated to CN1, pins 29 and 30	3
Pn50F.0	Output signal selection 2 CLIMT (current limit detection) signal output terminal allocation	0	No output	0
Pn50F.1	Output signal selection 2 VLIMT (speed limit detection) signal output terminal allocation	0	No output	0
Pn50F.2	Output signal selection 2 BKIR (brake interlock) signal output terminal allocation	2	Allocated to CN1, pins 27 and 28	0
Pn50F.3	Output signal selection 2 WARN (warning) signal output terminal allocation	0	No output	0
Pn510.0	Output signal selection 3 INP2 (positioning completed 2) signal output terminal allocation	0	No output	0
Pn510.1	Not used.	0	---	0
Pn510.2	Output signal selection 3 PSON (command pulse factor enabled) signal output terminal allocation	0	No output	0
Pn510.3	Not used.	0	---	0

Note The PCU uses the forward drive prohibited input, reverse drive prohibited input, and origin return deceleration limit switch allocated in the Servo Drive's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

6-4-3 W-series Servo Drive Settings (R88D-WN□-ML2 with Built-in MECHATROLINK-II Communications)

When the R88D-WN□-ML2 W-series Servo Drive equipped with built-in MECHATROLINK-II communications is used, the Servo Drive's default settings are used as the standard settings for MECHATROLINK communications.

Compulsory Parameter Settings

The following Servo parameters must be set to enable PCU control. Do not change this setting.

Pn800.0 Communications Control: MECHATROLINK Communications Check Mask

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn800.0	Communications control MECHATROLINK communications check mask	---	0	0: Communications errors (A.E6□) and synchronization errors (A.E5□) both detected.	0

The MECHATROLINK communications errors A.E6□ (communications errors) and A.E5□ (synchronization errors) are used when the PCU is controlling communications. Make sure to set this parameter so that these errors are always detected. Leave Pn800.0 set to the default setting 0 (detects communications errors (A.E6□) and synchronization errors (A.E5□)).

Pn800.1 Communications Control: Warning Check Mask

Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn800.1	Communications control Warning check mask	---	4 or 0	4: Communications warning (A.96□) ignored. 0: A.94□, A.95□, and A.96□ all detected.	4

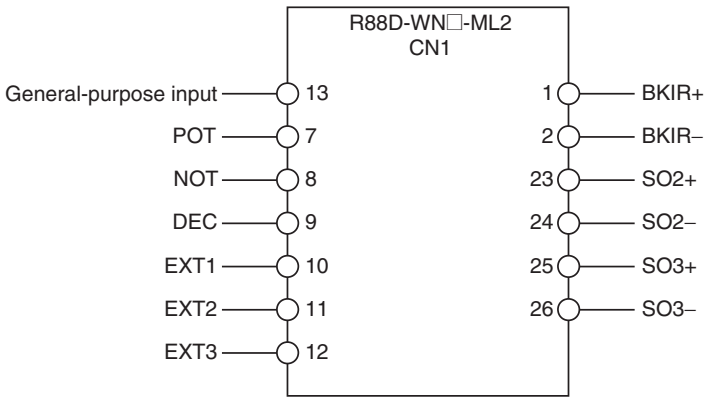
The MECHATROLINK communications warnings A.94□ (parameter setting warning) and A.95□ (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96□) only) or set to 0 (detects A.94□, A.95□, and A.96□).

Standard Settings for I/O Signals Using MECHATROLINK

When the R88D-WN□-ML2 W-series Servo Drive equipped with built-in MECHATROLINK-II communications is used, the Servo Drive's default I/O signal allocations are used as the standard settings for MECHATROLINK communications.

The standard settings for input signals use the position control functions, such as PCU limit inputs, origin search inputs, and interrupt feeding inputs. The default I/O signal allocations of the Servo Drive should thus be used.

I/O Signal Allocations (Default Settings)



Note The PCU uses the forward drive prohibited input, reverse drive prohibited input, and origin return deceleration limit switch allocated in the Servo Drive's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

6-4-4 SMARTSTEP Junior Servo Drive Settings (R7D-ZN□-ML2 with Built-in MECHATROLINK-II Communications)

When the R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive Settings equipped with built-in MECHATROLINK-II communications is used, the Servo Drive's default settings are used as the standard settings for MECHATROLINK communications.

Compulsory Parameter Settings

The following Servo parameter must be set to enable PCU control. Do not change this setting.

Pn800.1 Communications Control: Warning Check Mask

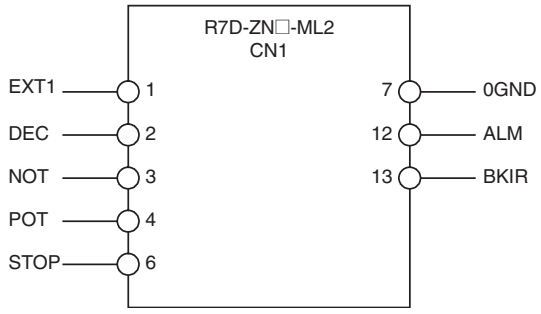
Parameter No.	Parameter name	Unit	Fixed setting	Details	Default setting
Pn800.1	Communications control Warning check mask	---	4 or 0	4: Communications warning (A.96) ignored. 0: A.94, A.95, and A.96 all detected.	4

The MECHATROLINK communications warnings A.94 (parameter setting warning) and A.95 (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96) only) or set to 0 (detects A.94, A.95, and A.96).

Standard Settings for I/O Signals When Using MECHATROLINK

When the R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive equipped with built-in MECHATROLINK-II communications is used, the Servo Drive's default settings are the standard settings for I/O signals for MECHATROLINK communications. The standard I/O signal settings are used for limit inputs, origin searches, interrupt feeding, and other position control functions of the Position Control Unit. Use the default settings for the I/O signal allocations for the Servo Drive.

I/O Signal Allocations (Default Settings)



Note The PCU uses the forward drive inhibit input, reverse drive inhibit input, and origin proximity input allocated in the Servo Drive's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

SECTION 7
Position Control Structure

This section provides an overview of the control system used by the Position Control Unit, including information on the control units, coordinate system, acceleration/deceleration operations, and limit input operations.

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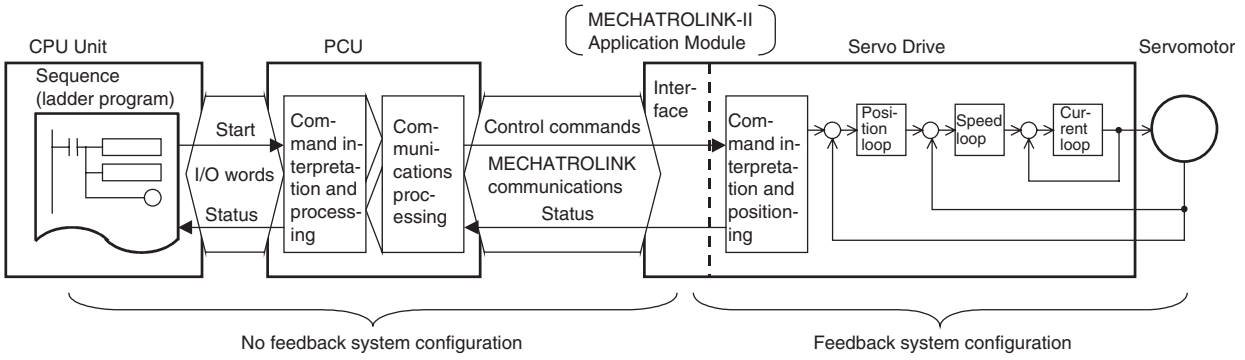
7-1 PCU Control System

This section describes the configuration, principles, and basic information on position control when using a control system configured with a PCU and a W-series Servo Drive.

7-1-1 Control System Configuration and Principles

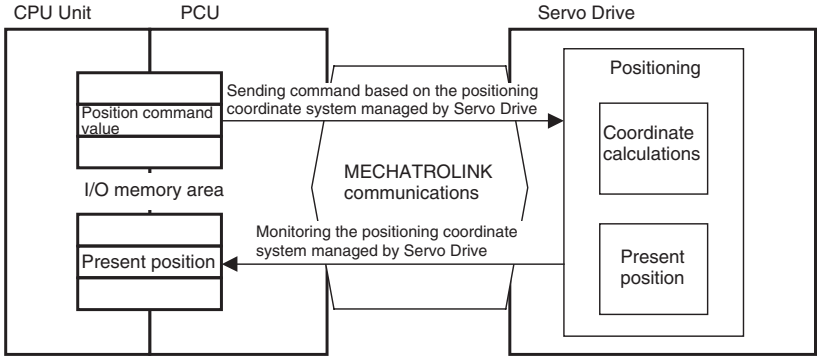


The control system configured using the PCU basically controls Servomotor operations using the semi-closed loop method. The semi-closed loop method detects the number of Servomotor rotations for the command value using the rotary encoder mounted to the Servomotor, and sends this feedback as the machine's travel distance. While calculating the deviation between the command value and actual number of Servomotor rotations, the machine is controlled so that the deviation is compensated to 0.

In the PCU system configuration, a feedback system is configured in the Servo Drive, without using feedback information for the commands sent from the CPU Unit's ladder program to the PCU and Servo Drive.

7-1-2 Position Control

The control system configured using the PCU uses the Servo Drive's position loop to perform position control. The PCU achieves positioning by using the Servo Drive's position control functions together with control units and coordinate systems.



7-2 Control Units

7-2-1 Control Units for Position Control

Control Units for Position Control

The command units are used as the basic control units for the position command values and speed command values that the PCU uses in position control axis operations, such as direct operation, origin searches, and jogging. (The unit for speeds is command units/s.) These units are determined by the electronic gear ratio in the Servo Parameters. The Servo Parameter settings such as *Positioning Completion Range* and *Software Limit* and the present position monitor unit input in the CPU Unit are also based on these command units.

The *Electronic Gear Ratio G1/G2* parameters determine the ratio between the command unit and travel distance (pulse unit) of the Servomotor.

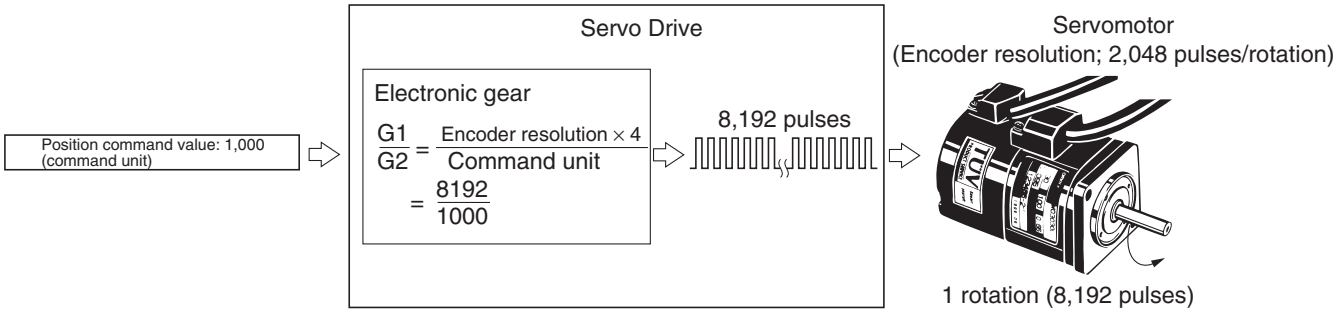
Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn205	Electronic gear ratio 1 (numerator)	---	0 to 131072	4	1
	Pn206	Electronic gear ratio 2 (denominator)	---	1 to 65535	4	1
R88D-WT□	Pn202	Electronic gear ratio G1 (numerator)	---	1 to 65535	2	4
	Pn203	Electronic gear ratio G2 (denominator)	---	1 to 65535	2	1
R88D-WN□-ML2	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	4
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
SMART-STEP Junior	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1

Set the electronic gear ratio such that $0.01 \leq G1/G2 \leq 100$ when using R88D-GN□ G-series Servo Drives, R88D-WT□ W-series Servo Drives, or SMART-STEP Junior Servo Drives and such that $0.001 \leq G1/G2 \leq 1000$ when using R88D-WN□-ML2 W-series Servo Drives.

In the Servo Drive, the control unit is the pulse unit determined by the Servomotor's encoder resolution. (The Servo Drive operates internally with a pulse multiplier of four. Therefore, the Servomotor's encoder resolution multiplied by four is the number of pulses in one rotation.) The electronic gear ratio is used to convert the command value (i.e., command units) handled by the PCU into the control unit (i.e., pulses) used in the Servo Drive (the G1/G2 unit is pulses/command unit.) When the Servo Drive's default setting (G1/G2 = 4/1) is used, the command unit is the number of pulses equivalent to the Servomotor's encoder resolution.

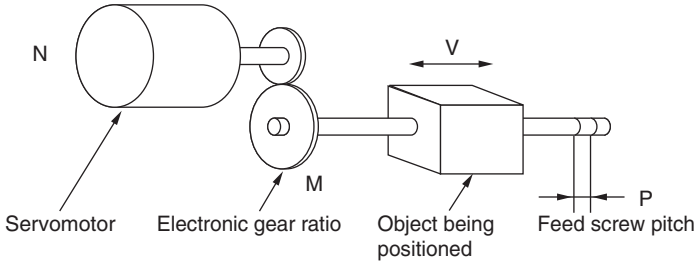
Servomotor with 2,048 (Pulses/Rotation) Encoder

When set to G1/G2 = 8192/1000, the command units for which the Servomotor makes one rotation for a position command value of 1,000 can be obtained.



Command Unit Setting Example

Consider the following positioning example.



M: Deceleration gear ratio
V: Feed speed of object being positioned (mm/s)
P: Feed screw pitch (mm/rotation)
R: Servomotor encoder resolution (pulses/rotation)

The equation for calculating the distance traveled per Servomotor encoder resolution pulse is as follows:

$$\frac{\text{Feed screw pitch}}{(\text{Servomotor encoder resolution} \times 4) \times (\text{deceleration ratio})} = \frac{\text{P (mm/rotation)}}{\text{R (pulses/rotation)} \times 4 \times \text{M}} \text{ (mm/pulse)}$$

The Servo Drive performs control internally at four times the Servomotor's encoder resolution. Therefore, in the above equation, the Servomotor's encoder resolution is multiplied by four. If the command unit used is mm, the electronic gear ratio is set as the reciprocal of the above equation and G1/G2 is set as follows:

$$\text{Command unit (mm): } \frac{\text{G1}}{\text{G2}} = \frac{\text{R (pulses/rotation)} \times 4 \times \text{M}}{\text{P (mm/rotation)}} \text{ (pulses/mm)}$$

If the command unit used is 0.01 mm (= 10 μm), the unit is converted by multiplying the travel distance per encoder resolution pulse by 100, and the electronic gear ratio is set as follows:

$$\text{Command unit (0.01 mm): } \frac{\text{G1}}{\text{G2}} = \frac{\text{R (pulses/rotation)} \times 4 \times \text{M}}{\text{P (mm/rotation)} \times 100} \text{ (pulses/0.01 mm)}$$

7-2-2 Control Units for Speed/Torque Control

The unit used for the speed command value in speed control is the percentage (unit: 0.001%) of the Servo Drive's/Servomotor's momentary maximum rotation speed. The unit used for the torque command value in torque control is the percentage (unit: 0.001%) of the Servo Drive's/Servomotor's momentary maximum torque. The Servomotor's momentary maximum rotation speed and momentary maximum torque depend on the Servomotor model.

For details on specifications, refer to the corresponding operation manuals for the Servo Drive and Servomotor.

7-2-3 Units of the PCU's Main Controlled Variables

Function	Category	Controlled variable	Unit	Details
Common	Servo Parameter data	Torque limit value	%	(percentage of Servomotor's rated torque)
	Monitor value	Feedback present position	Command unit	---
		Command present position	Command unit	---
		Position deviation	Command unit	---
Position control	Command value	Position command value	Command unit	---
		Speed command value	Command units/s	---
	Servo Parameter data	Acceleration	10,000 command units/s^2	---
		Deceleration	10,000 command units/s^2	---
		Zero point return approach speed 1	100 command units/s	---
		Zero point return approach speed 2	100 command units/s	---
	Monitor value	Speed monitor value	Command units/s	---
		Torque monitor value	%	(percentage of Servomotor's rated torque)
Speed control	Command value	Speed command value (for speed control)	0.001%	(percentage of Servomotor's momentary maximum rotation speed)
		Torque limit value (option command value)	%	(percentage of Servomotor's momentary maximum torque)
	Monitor value	Speed monitor value	0.001%	(percentage of Servomotor's momentary maximum rotation speed)
		Torque monitor value	%	(percentage of Servomotor's rated torque)
Torque control	Command value	Torque command value	0.001%	(percentage of Servomotor's momentary maximum torque)
		Speed limit value (option command value)	0.001%	(percentage of Servomotor's momentary maximum rotation speed)
	Monitor value	Speed monitor value	Command units/s	---
		Torque monitor value	0.001%	(percentage of Servomotor's momentary maximum torque)

The units for speed and torque depend on the control mode (position, speed, or torque control). For details, refer to *10-5 Speed Control*, and *10-6 Torque Control*.

Note The resolution of the controlled variables that can be monitored by the PCU depends on the specifications of the connected Servo Drive.

For example, when using a W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module, the minimum resolution for the command speed monitor value and feedback speed in position/torque control is 1,000 command units/s.

Depending on the PLC's cycle time and MECHATROLINK communications cycle, short-term changes in status of the Servo Drive may not be monitored successfully.

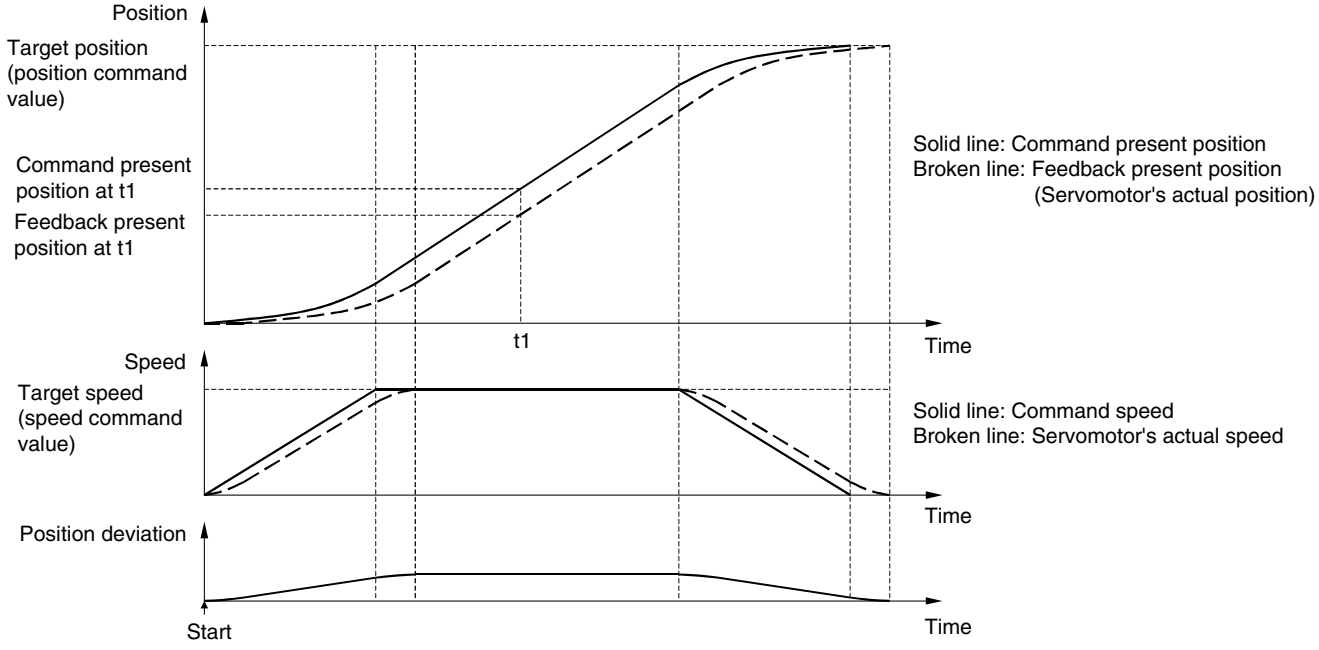
7-3 Coordinate System and Present Position

The PCU uses a single coordinate system based on the origin determined for each axis using the origin defining functions. This coordinate system provides two types of present positions for each axis: a feedback present position and a command present position.

Feedback/Command Present Position

The Servo Drive uses a rotary encoder to detect Servomotor rotations (providing feedback), and the Servomotor is controlled so that the deviation between the feedback and command values is compensated to 0. Therefore, while a position deviation remains in the Servo Drive, a difference equivalent to the position deviation between the position command value and the integrated value of the feedback, which indicates the actual machine (Servomotor) position, should exist.

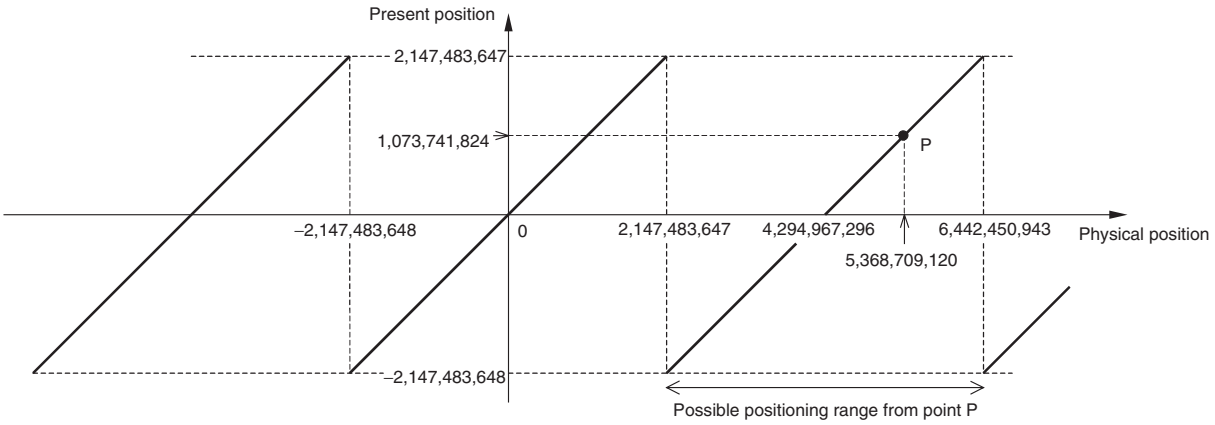
The PCU outputs to the I/O memory area allocated for each axis in the CPU Unit the amount of feedback indicating the actual position of the machine (Servomotor) as the feedback present position and the position given in the command as the command present position.



Note When executing speed control and torque control commands, there is no command present position because a positioning loop is not configured. A command present position calculated from the position deviation assumed from the current speed is output as monitor information.

Present Position Upper/Lower Limits

The feedback present position and command present position can be displayed as values in the range –2,147,483,648 to 2,147,483,647 (command units). When an operation in a fixed direction without a target position using jogging, speed control, or torque control is continued, the present value that exceeds the above range and is not limited by limit input signals or software limits is given as follows:



For example, if the physical position is 5,368,709,120 (command units), as indicated by point P in the above diagram, which exceeds 2,147,483,647 (command units), 1,073,741,824 will be given as the present position (command units).

The position range for the ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands is –2,147,483,648 to 2,147,483,647 (command units) for the command present position when they are not limited by limit input signals or software limits.

If the physical position is point P in the diagram, the physical position that can be moved to using ABSOLUTE MOVEMENT or RELATIVE MOVEMENT is 2,147,483,648 to 6,442,450,943 (command units). The PCU will treat the position command value and present position in the range as –2,147,483,648 to 2,147,483,647 (command units).

Note With the direct operation position range, the operation for position command values is different for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands. Refer to *9-4-1 Starting Direct Operation* for further details.

7-4 Acceleration and Deceleration Operations

The acceleration and deceleration operations that can be used when the PCU is connected to a G-series Servo Drive, W-series Servo Drive, or SMARTSTEP Junior Servo Drive are described here.

7-4-1 Overview of Acceleration/Deceleration Operations

The PCU creates the specified acceleration/deceleration curve for the operating commands performing position control, such as direct operation or origin searches. The acceleration/deceleration speed settings are set for each axis according to the Servo Parameters for acceleration/deceleration and are enabled for the following acceleration/deceleration operations.

Operating command	Acceleration operation	Deceleration operation
ABSOLUTE MOVEMENT/ RELATIVE MOVEMENT	Starting Changing speed (acceleration) Changing override (acceleration)	Stopping positioning Changing speed (deceleration) Changing override (deceleration)
JOG	Starting jogging Changing speed (acceleration) Changing override (acceleration)	Stopping jogging Changing speed (deceleration) Changing override (deceleration)
ORIGIN SEARCH	See *7-4-4 Origin Search Acceleration/Deceleration Operations*	See *7-4-4 Origin Search Acceleration/Deceleration Operations*

Operating command	Acceleration operation	Deceleration operation
DECELERATION STOP	---	Decelerating to a stop
Errors with DECELERATION STOP	---	When errors occur

Acceleration/deceleration curves cannot be set for speed control or torque control. Continuous speed changes using speed control, however, are possible by setting the *Soft Start Acceleration Time* and *Soft Start Deceleration Time* in the Servo Parameters.

7-4-2 Acceleration/Deceleration Settings

The acceleration/deceleration settings are set for each axis according to the Servo Parameters for acceleration/deceleration. Set these Servo Parameters using WRITE/SAVE SERVO PARAMETER before sending operating commands.

Do not change the acceleration/deceleration constants during axis operation (i.e., while the Busy Flag for the corresponding axis is ON due to execution of an operating command). Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

G-series Servo Parameters

Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	G Series
Acceleration/ deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100	Supported
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100	Supported

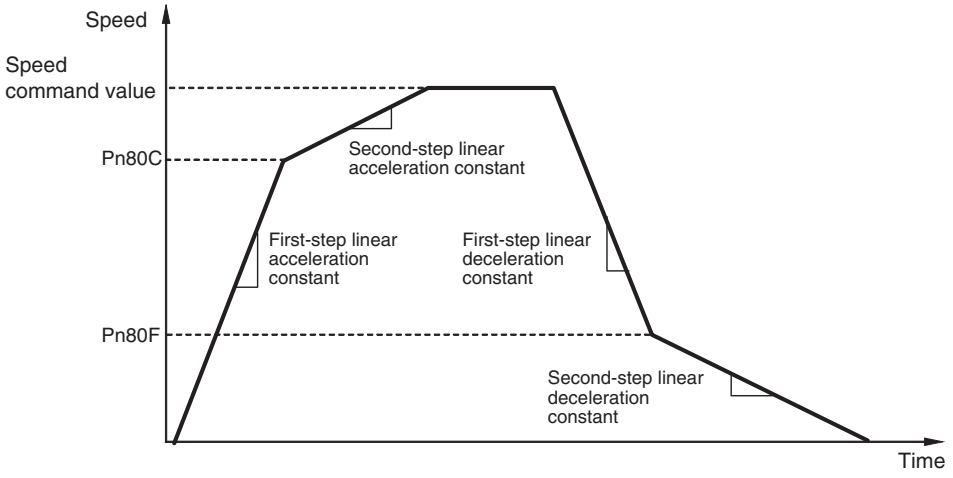
Note When using G-series Servo Drives, one-step linear acceleration/deceleration curves are set using only Pn107 and Pn10A.
When the parameter is set to 0, it is taken as 1.
The setting will be used after conversion to unsigned 16-bit data (0 to 65536).
Examples: –32768 is converted to 8000 hex = 32768
–1 is converted to FFFF hex = 65535

W-series and SMARTSTEP Junior Servo Parameters

Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
Acceleration/deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.



To operate an axis using only a first-step acceleration/deceleration curve with a W-series Servo Drive, only settings for the parameters Pn80B and Pn80E are required if the default settings (0) are used for the Servo Parameters *Acceleration Constant Switching Speed* and *Deceleration Constant Switching Speed* (Pn80C and Pn80F).

Unit for Acceleration/Deceleration Constants

The unit for the acceleration/deceleration filters set in the Position Control Unit is 10000 command units/s^2 using the command unit determined by the electronic gear ratio in the Servo parameters.

The setting of the command unit can cause the setting unit for the acceleration/deceleration constants to become imprecise or changes in the setting can greatly affect the size of accelerations/decelerations.

To create a more precise setting unit for accelerations/decelerations, increase the resolution of the command unit (i.e., increase the number of digits).

Example

If the command unit is 0.1 mm, the target speed is 1,000 mm/s (1,000.0 mm/s = 10,000 command units/s) and the target speed must be reached in 250 ms, the acceleration constant would be set to 4, as shown below.

1000 [command units/s]/250 [ms] = 40,000 [command units/s^2]
= 4 [10,000 command units/s^2]

If the acceleration constant is increased or decreased by only 1, the acceleration time required to reach the same target speed is greatly affected, as shown below:

Acceleration constant = 3:10000 [command units/s]/3 [10,000 command units/s^2] = 333 [ms]

Acceleration constant = 5:10000 [command units/s]/5 [10,000 command units/s^2] = 200 [ms]

If the precision of the command unit is increased by 2 digits to 0.001 mm, the acceleration constant would be set to 400 to reach the same target speed of 1,000 mm/s (1000.000 mm/s = 1,000,000 command units/s) in the same time of 250 ms.

1,000,000 [command units/s]/250 [ms] = 4,000,000 [command units/s^2]
= 400 [10,000 command units/s^2]

If the acceleration constant is increased or decreased by 1, the acceleration time required to reach the same target speed is affected very little, as shown below:

Acceleration constant = 399:1000000 [command units/s]/399 [10000 command units/s^2] = 250.6 [ms]

Acceleration constant = 401:1000000 [command units/s]/401 [10000 command units/s^2] = 249.3 [ms]

7-4-3 Acceleration/Deceleration Filter Settings

When a W-series Servo Drive is connected, acceleration/deceleration filters can be set for each axis to avoid rapid changes in acceleration or deceleration. A acceleration/deceleration filter can be set for each axis to enable nonlinear acceleration/deceleration curves. Using an acceleration/deceleration filter enables an exponential acceleration/deceleration curve and acceleration/deceleration S-curves using a movement (running) average.

The G-series Servo Drives do not support exponential filters, but acceleration/deceleration S-curves using a moving average can be used.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and the filters cannot be set.

To use the acceleration/deceleration filter, set the acceleration/deceleration curve designation in the Axis Operating Output Memory Area when specifying the operating command as well as setting the acceleration/deceleration filter settings in the Servo Parameters.

Servo Parameters **Acceleration/Deceleration Constants**

Type	Parameter name for G Series (Parameter name for W Series)	Unit	Setting range	Parameter size	Default setting	G Series	W Series	SMART-STEP Junior
Acceleration/ deceleration filters	Exponential acceleration/deceleration bias	Command units/s	0 to 32767	2	0	Not supported	Pn810	Not supported
	Exponential acceleration/deceleration time constant	0.1 ms	0 to 5100	2	0	Not supported	Pn811	Not supported
	Moving average time (Movement average time)	0.1 ms	0 to 5100	2	0	Pn10E	Pn812	Not supported

For W-series Servo Drives, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve for the acceleration/deceleration curve.

For G-series Servo Drives, Pn10E must be set when using an S-curve.

Axis Operating Output Memory Areas

Name		Word	Bit	Contents	G Series	W Series	SMARTSTEP Junior
Acceleration/deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/deceleration curve.	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The acceleration/deceleration curve designation setting is enabled when the bit for the movement command turns ON.

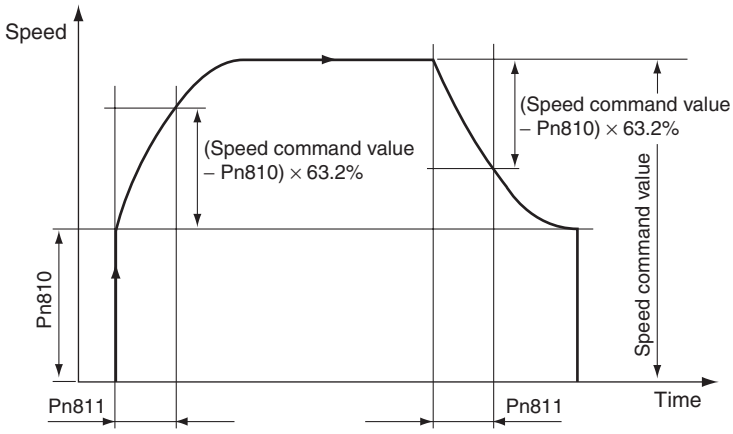
Note

(1) Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

(2) If an error occurs, the acceleration/deceleration curve for the deceleration stop operation will be that currently specified in the acceleration/deceleration curve designation, except for limit inputs and software limits. To use a non-linear acceleration/deceleration curve for the deceleration stop operation both when an error occurs and when operation is normal, make sure that the acceleration/deceleration curve designation is kept enabled during axis operations.

(3) Change the acceleration/deceleration constants using WRITE SERVO PARAMETER while axis operation is stopped (Busy Flag =0). Do not change parameters during axis operation. Changing parameters of an active axis may result in incorrect positioning or other malfunction.

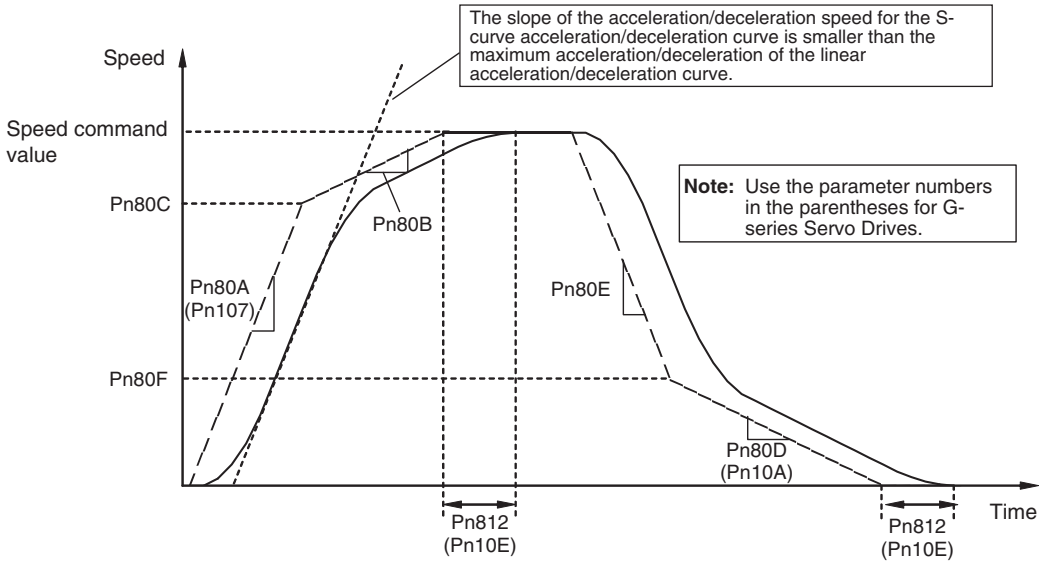
Exponential Acceleration/Deceleration Curve



The acceleration/deceleration for the exponential acceleration/deceleration curve is determined by the Servo Parameters *Exponential Acceleration/Deceleration Bias* (Pn810) and *Exponential Acceleration/Deceleration Time Constant* (Pn811). The speed set in *Exponential Acceleration/Deceleration Bias* (Pn810) is used as the start speed. The time until reaching 63.2% of the difference between the speed command value and the start speed is set in the *Exponential Acceleration/Deceleration Time Constant* (Pn811).

When an exponential acceleration/deceleration curve is used, the acceleration/deceleration time is always fixed regardless of the speed command value.

S-curve (Movement Average) Acceleration/Deceleration Curve

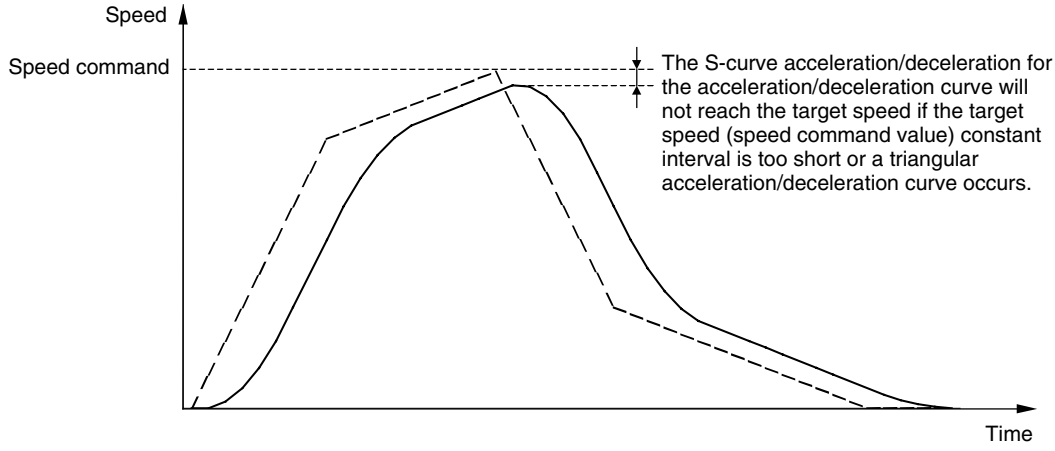


The S-curve acceleration/deceleration curve obtains the moving average using the Servo Parameter *Movement Average Time* for W-series Servo Drives (Pn812) or *Moving Average Time* for G-series Servo Drives (Pn10E) for the linear acceleration/deceleration curve specified in Pn80A to Pn80F (Pn106 to Pn10B when using a G-series Servo Drive) to smooth out sudden changes in the acceleration/deceleration (acceleration/deceleration curve angle). The acceleration/deceleration for the S-curve acceleration/deceleration curve will not exceed the maximum acceleration/deceleration of the linear

acceleration/deceleration of the linear acceleration/deceleration curve prior to taking the moving average. Set the length of time in which the average acceleration/deceleration curve will be taken in the Servo Parameter *Movement Average Time* for W-series Servo Drives (Pn812) or *Moving Average Time* for G-series Servo Drives (Pn10E).

When there is a sufficient constant interval at the target speed (speed command value), the time taken to reach target speed for S-curve acceleration/deceleration is delayed in relation to the linear acceleration/deceleration curve by the set value for the Servo Parameter *Movement Average Time* for W-series Servo Drives (Pn812) or *Moving Average Time* for G-series Servo Drives (Pn10E). In the same way, the time required to stop after positioning will be delayed by this set amount.

If the constant speed interval for the target speed is less than the movement (running) average time or a triangular acceleration/deceleration curve occurs, the achieved speed of S-curve acceleration/deceleration will be less than the target speed.

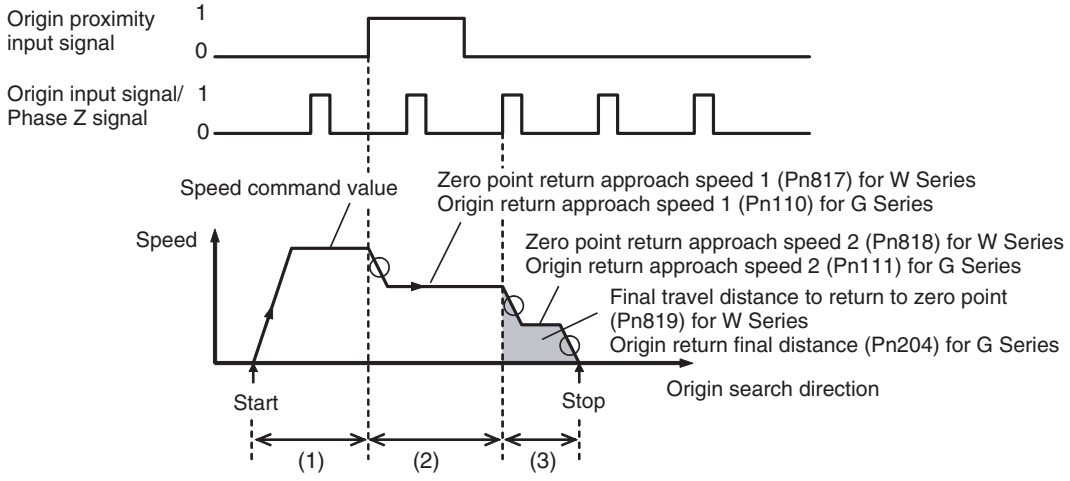

Speed
Speed command
The S-curve acceleration/deceleration for the acceleration/deceleration curve will not reach the target speed if the target speed (speed command value) constant interval is too short or a triangular acceleration/deceleration curve occurs.
Time

7-4-4 Origin Search Acceleration/Deceleration Operations

The origin search operation of the PCU consists of the following three steps.

1,2,3...

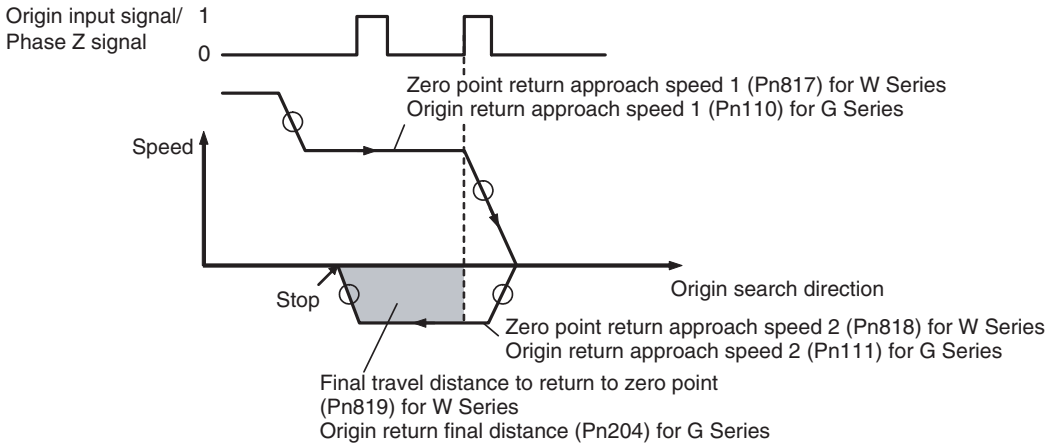
1. Search for origin proximity signal
2. Search for origin signal after detection of origin proximity signal
3. Positioning for final travel distance to return to zero point (origin) after detection of origin signal


Origin proximity input signal
1
0
Origin input signal/ Phase Z signal
1
0
Speed command value
Zero point return approach speed 1 (Pn817) for W Series
Origin return approach speed 1 (Pn110) for G Series
Speed
Zero point return approach speed 2 (Pn818) for W Series
Origin return approach speed 2 (Pn111) for G Series
Final travel distance to return to zero point (Pn819) for W Series
Origin return final distance (Pn204) for G Series
Origin search direction
Start
Stop
(1)
(2)
(3)

For details on the origin search, refer to *8-2 Origin Search Operation*.

The acceleration when origin search starts and the speed change when switching to another step depend on the acceleration/deceleration curve (circled in above diagram) determined by the acceleration/deceleration filter setting and acceleration/deceleration set in Servo Parameters (Pn80A to Pn812 for W Series, Pn107 and Pn10A for G Series).

When the final travel distance to return to zero point (origin) is a negative or small value, the axis will decelerate to a stop as shown in the following diagram, and then reverse and perform the set positioning. Both the deceleration and acceleration will be determined also by the set acceleration/deceleration curve (circled in following diagram).


Origin input signal/
Phase Z signal
1
0
Zero point return approach speed 1 (Pn817) for W Series
Origin return approach speed 1 (Pn110) for G Series
Speed
Stop
Origin search direction
Zero point return approach speed 2 (Pn818) for W Series
Origin return approach speed 2 (Pn111) for G Series
Final travel distance to return to zero point
(Pn819) for W Series
Origin return final distance (Pn204) for G Series

If the reversal mode operation using limit input is set, however, the stop operation when a limit input signal is input will depend on the Servo Drive setting. For details on stop operations when using limit input signal inputs, refer to *7-5 Limit Input Operations* and *Reversal Mode Operation Using Limit Inputs* in *8-2-4 Origin Search Operation*.

7-4-5 Acceleration and Deceleration Operations during Speed Control

When the speed control command is executed, the Servo Drive performs stepped speed control from the present feedback speed to the target speed specified in the speed command value for speed control. Apart from smoothly increasing/decreasing the speed command value (for speed control) when starting speed control, shock in acceleration/deceleration when performing speed control can also be minimized by setting the Servo Parameters *Soft Start Acceleration Time* (Pn058 for G Series and Pn305 for W Series) and *Soft Start Deceleration Time* (Pn059 for G Series and Pn306 for W Series) to create a trapezoidal speed curve.

For details on speed control, refer to *10-5 Speed Control*.

G-series Acceleration/Deceleration Constants for Speed Control

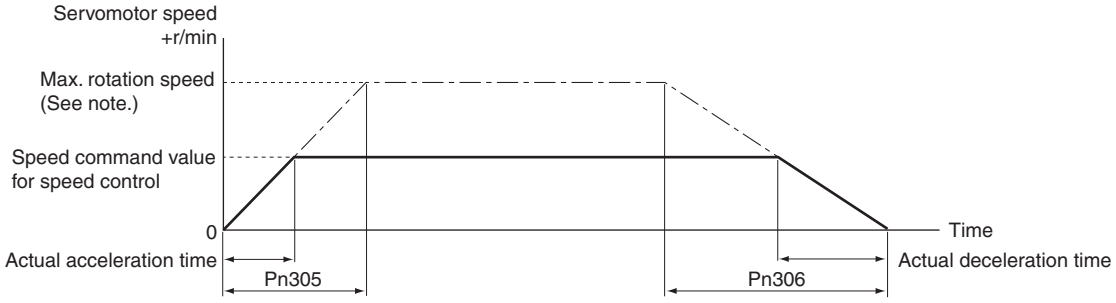
Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Pn058	Soft start acceleration time	×2ms	0 to 5000	2	0
Pn059	Soft start deceleration time	×2ms	0 to 5000	2	0

W-series Acceleration/Deceleration Constants for Speed Control

Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Pn305	Soft start acceleration time	ms	0 to 10000	2	0
Pn306	Soft start deceleration time	ms	0 to 10000	2	0

The *Soft Start Acceleration Time* and *Soft Start Deceleration Time* are set respectively as the acceleration time and deceleration time between speed 0 (speed command value for speed control: 0%) and the maximum rotation speed of the Servomotor (speed command value for speed control: 100%). The acceleration time and deceleration time for the actual target speed are as follows:

$$\text{Actual acceleration (deceleration) time} = \frac{\text{Speed command value for speed control (r/min)}}{\text{Maximum rotation speed (r/min)}} \times \text{Soft start acceleration (deceleration) time}$$



Note The maximum rotation speed depends on the Servomotor used. Refer to the maximum momentary rotation speed for the Servomotor used. The following values apply to W-series Servomotors.

3,000-r/min Servomotor (cylinder type or flat type): 5,000 r/min
1,000-r/min Servomotor: 2,000 r/min
1,500-r/min Servomotor (450 W to 7.5 kW): 3,000 r/min
1,500-r/min Servomotor (11 to 15 kW): 2,000 r/min

7-5 Limit Input Operations

The PCU uses the Servo Drive's internal forward drive prohibited signal input and reverse drive prohibited signal input as the forward rotation limit input signal and reverse rotation limit input signal, respectively. Additionally, the forward/reverse software limits can be used by setting the Servo Parameters.

The stop operation when the forward/reverse rotation limit input signal is input, and the forward/reverse software limit is reached depend on the Servo Parameter settings, as shown in the following table.

	Travel direction limit	Reverse travel direction limit (See note 1.)
Limit input signal	The Servomotor operation is stopped at the Servo Drive according to the setting of Servo Parameter Pn001.1 (Pn004 for G Series). At the PCU, a limit input error occurs, causing an emergency stop, except when using the origin search operation's reversal mode.	An emergency stop caused by a limit input error is executed at the PCU, except when executing ORIGIN SEARCH.
Software limit	The Servomotor operation is stopped at the Servo Drive according to the setting of Servo Parameter Pn001.1 (Pn004 for G Series). (See note 2.) At the PCU, a software limit error occurs, causing an emergency stop.	---

Note

(1) This operation occurs when a limit input signal is input in the direction opposite to the travel direction due to incorrect wiring or other cause.

(2) For details on software limit functions, refer to *10-8 Software Limits*.

(3) If the limit input signal inputs (Servo Drive's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Drive will not stop the Servomotor when the signal is input, and the PCU will also not detect limit inputs as errors. When using a PCU, always allocate the Servo Drive's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.)

(4) Make sure that the limit input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. Input signals that are shorter than the communications cycle cannot be detected by the PCU.

When using a G-series Servo Drive or W-series Servo Drive, the Servomotor's stop operation at the Servo Drive when a limit input signal is input or a software limit is reached is set in the Servo Parameters for limit input operations.

When using a SMARTSTEP Junior Servo Drive, the Servo is locked after decelerating to a stop with the maximum Servomotor torque. The following function cannot be used.

Servo Parameters

G-series Limit Input Parameters

Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Pn066	Stop selection for drive prohibition input	---	0 to 2	2	0
Pn06E	Emergency stop torque	%	0 to 300	2	0

Pn066 is used to set the stop operation of the Servomotor when a forward/reverse rotation limit is input or a forward/reverse software limit is reached. The parameter size of Pn066 is the value to be specified when transferring the Servo Parameter Pn066 including the above settings.

The following table shows the Servomotor stop operations using Pn066 settings.

Parameter No.	Setting	During deceleration	After stopping	Deviation counter
Pn066	0	Dynamic brake	Disables torque command in drive prohibited direction	Cleared while decelerating with dynamic brake. Retained after stopping.
	1	Disables torque	Disables torque command in drive prohibited direction	Cleared while decelerating. Retained after stopping.
	2	Emergency stop torque (Pn06E)	Servo lock	Retained while decelerating, cleared upon completion of deceleration, and retained after stopping.

Note

(1) If an operation command in the drive prohibited direction is received when the torque command of the drive prohibited direction is disabled, the Servomotor will not operate in the drive-prohibited direction, but the position deviation will accumulate because the torque command is enabled. If drive prohibition is detected, stop the operation command from the host controller and take measures such as executing a command in the reverse direction.

(2) The positioning command generation process (positioning operation) within the Servo Drive will be forcibly stopped after it enters the deceleration mode. Also, when the deceleration mode is activated during speed control or torque control, it will switch to position control.

(3) When the Servomotor rotation speed is 30 r/min or less (stopped), the deceleration mode will not be entered even if the drive prohibit input is enabled.

W-series and SMARTSTEP Junior Limit Input Parameters

Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Pn001.1	Function selection application switch 1 Select stop when prohibited drive is input	---	0 to 2	2	0
Pn406	Emergency stop torque	%	0 to 800	2	350

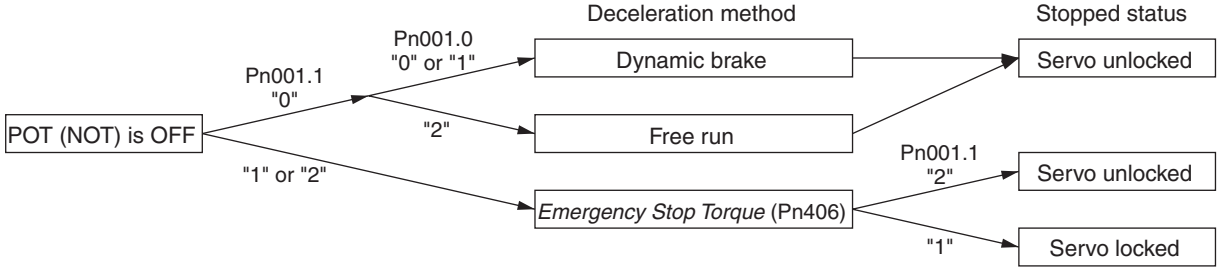
Note The Pn406 default setting corresponds to that used for W-series Servo Drives.

Pn001.1 is used to set the stop operation of the Servomotor when a forward/reverse rotation limit input is input or a forward/reverse software limit is reached. The parameter size of Pn001.1 in the above table is the set value to be specified when transferring the Servo Parameter Pn001 (including Pn001.1).

The following table shows the Servomotor stop operations using Pn001.1 settings.

<table>
<tr><th>Parameter No.</th><th>Set value</th><th>Details</th></tr>
<tr><td rowspan="3">Pn001.1</td><td>0</td><td>Stops operation according to the setting in Pn001.0 (selects stop if an alarm occurs when Servomotor is OFF).
Puts Servomotor in Servo unlock status after stopping operation.
<table>
<tr><th>Parameter No.</th><th>Set value</th><th>Details</th></tr>
<tr><td rowspan="3">Pn001.0</td><td>0</td><td>Servomotor stopped by dynamic brake.
Dynamic brake held after stopping.</td></tr>
<tr><td>1</td><td>Servomotor stopped by dynamic brake.
Dynamic brake OFF after stopping.</td></tr>
<tr><td>2</td><td>Servomotor stopped with free run.</td></tr>
</table></td></tr>
<tr><td>1</td><td>Stops Servomotor using torque set in Emergency Stop Torque (Pn406).
Puts Servomotor in Servo lock status after stopping operation.</td></tr>
<tr><td>2</td><td>Stops Servomotor using torque set in Emergency Stop Torque (Pn406).
Puts Servomotor in Servo unlock status after stopping operation.</td></tr>
</table>

Stopping Methods when Forward/Reverse Drive Prohibit Is OFF



Note The brake interlock output (BKIR output) will not function while there is a limit input signal (Servo Drive's forwarded drive prohibited signal or reverse drive prohibited signal) or while the Servo is unlocked as the result of reaching a software limit. Unlock the Servo before activating a machine holding brake.

SECTION 8
Defining the Origin

This section provides information on the various operations used to determine the origin, including origin searches, origin returns, presetting the present position, calculating phase Z margins, and using the absolute encoder.

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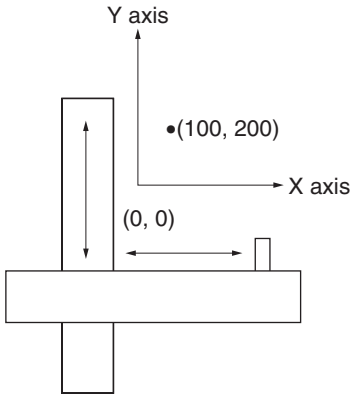
8-1 Overview

When performing positioning for a system in terms of absolute positions in that system, it is first necessary to define the origin. For example, in the X-Y plane shown below, before positioning to (X, Y) = (100 mm, 200 mm), the origin (0,0) of the machine must be established, i.e., it is necessary to define the origin.



With the PCU, the mechanical origin can be defined using any of the following three methods.

Name	Contents
ORIGIN SEARCH	The origin is determined by actually operating the Servomotor and using the limit input signal, origin proximity input signal, and origin input signal. A photoelectric sensor or the phase Z signal from an encoder can be used as the origin input signal. Execute this function when using an incremental encoder Servomotor or Servomotor with absolute encoder used as an incremental encoder.
PRESENT POSITION PRESET	The origin can be determined by forcibly setting the position at which the Servomotor is stopped to a user-specified position.
ABSOLUTE ENCODER ORIGIN	By using a Servomotor with absolute encoder, the absolute value data saved in the encoder can be read and the mechanical origin can be established when starting to use the device.

The PCU also features a positioning function to return to the established origin.

Name	Contents
ORIGIN RETURN	Positioning is performed from the position where the Servomotor is stopped to the origin that has been established using ORIGIN SEARCH or PRESENT POSITION PRESET.

The PCU can also be operated without defining the origin but the axis operation for each function is as follows:

Function	Operation
JOG	Can be executed.
ORIGIN RETURN	Cannot be executed. If executed, a Present Position Unknown Error (axis error code: 3030 hex) will occur.

Function		Operation
Position control	ABSOLUTE MOVEMENT	Cannot be executed. If executed, a Present Position Unknown Error (axis error code: 3030 hex) will occur.
	RELATIVE MOVEMENT	Can be executed.
	INTERRUPT FEEDING	Can be executed only with RELATIVE MOVEMENT. If executed with ABSOLUTE MOVEMENT, a Present Position Unknown Error (axis error code: 3030 hex) will occur, and the function will not be executed.
SPEED CONTROL		Can be executed.
TORQUE CONTROL		Can be executed.

For G-series Servo Drives and W-series Servo Drives used with incremental encoders or absolute encoders used as incremental encoders, the present position is taken as 0 when the power is turned ON. When the executable functions shown in the above table are executed by the PCU without a defined origin, the present position will be calculated from the position of the axis (0) when the power was turned ON with no origin established.

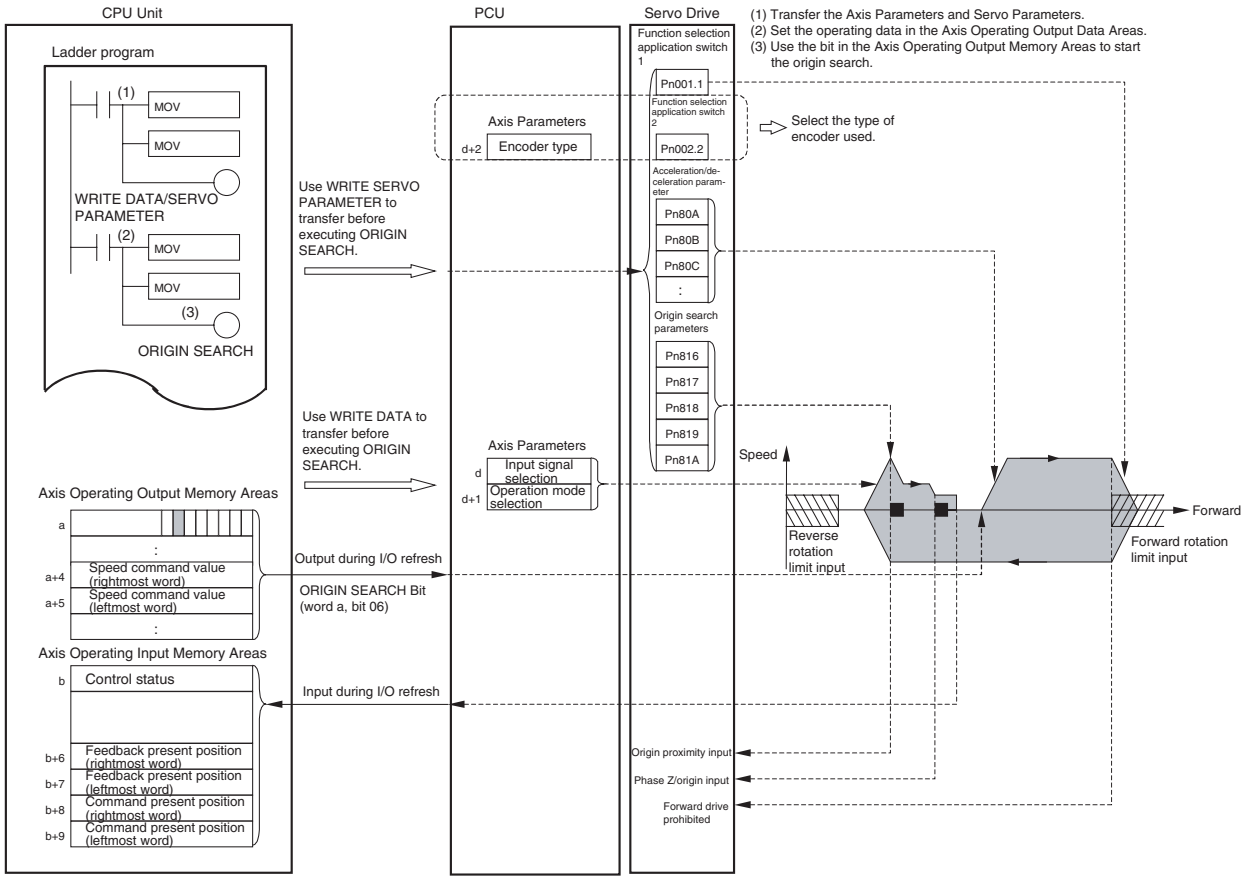
8-2 Origin Search Operation

8-2-1 Origin Search Overview

Origin searches are performed by actually operating the Servomotor, searching for the mechanical origin based on the limit input signal, origin proximity input signal, and origin input signal, and to define the origin.

Note In ORIGIN SEARCH execution, the present position is cleared to 0 at the same time when an origin is defined. Unless the Absolute Encoder Zero Point Position Offset is set using an Origin Search Operation with Position Control Units with unit version 2.0 or later, the absolute value data read to the PCU when SERVO LOCK was executed will be lost when the origin is established. (The absolute data saved in the absolute encoder will not be lost and can be obtained by executing SERVO LOCK after SERVO UNLOCK.) When using a Position Control Unit with unit version 2.0 or later and not setting an Absolute Encoder Zero Point Position Offset, execute ORIGIN SEARCH using either a Servomotor with incremental encoder or a Servomotor with absolute encoder that is used as an incremental encoder.

Origin Search Operation Diagram for W-series Servo Drives



a: Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25
b: Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. –1) × 25
d: 1860 hex + (Axis No. –1) × 14 hex

The speed command value set in the Axis Operating Output Memory Area using the MOV instruction is output to the PCU automatically during I/O refresh.

The origin search is started when the ORIGIN SEARCH Bit allocated in the Axis Operating Output Memory Area turns ON.

Note Once the origin is established by the PCU, it will not be lost if ORIGIN SEARCH is executed again. If ORIGIN SEARCH is executed again, the search operation will be executed using the coordinates based on the previous origin until the new origin is established. If the software limits are enabled at this point, the software limits will apply to the origin search operation, causing operation to stop due to an error. (Positioning will not be reversed at the software limits when origin searches are performed in reversal mode.) To execute ORIGIN SEARCH again after the origin has been established, either disable the software limits, or execute DEVICE SETUP or another operation that will cancel the origin (No Origin Flag = 1) before executing ORIGIN SEARCH.

8-2-2 Origin Search Procedure

Use the following procedure to perform an origin search.

1,2,3... 1. Set the Common Parameters and save them.
2. Set the Axis Parameters and save them.

3. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters and Axis Parameters set in steps 1 and 2 above are enabled.
4. Start MECHATROLINK communications.
5. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute origin searches.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory)
   To enable changed offline parameters, turn the power to the Servo Drive OFF and then ON again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
6. Execute SERVO LOCK.
7. Set the data used for origin search.
   Set the origin search speed data in the speed command value of the Axis Operating Output Memory Area.
8. Execute ORIGIN SEARCH.

When using the PCU for the first time or to change the PCU parameter settings, steps 1 to 3 must be performed.

Note To specify the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change the settings during axis operation. Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

8-2-3 Data Settings Required for Origin Search

A simple explanation of the main parameters and data used to execute ORIGIN SEARCH is provided here. For details on the parameters required when using absolute encoders, refer to *8-6 Absolute Encoder Origin*.

To execute ORIGIN SEARCH, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.
  The origin proximity input signal must be allocated to execute ORIGIN SEARCH.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.

Axis Parameter Area The following parameters are for the operation mode for origin searches.

PCU's address	Contents						Setting
	15 to 14	13	12	11 to 08	07 to 04	03 to 00	
d+1	0 (fixed)	Origin search preset	Origin search direction	Origin detection method	Origin search operation	0 (fixed)	Set the origin search operation. Origin search direction 0: Reversal mode 1 (default setting) 1: Reverse mode 2 2: Single-direction mode 3: Reversal mode 3 (See note.) Origin detection method (See note.) 0: With origin proximity input signal reversal (default setting) 1: Without origin proximity input signal reversal 2: Not use origin proximity input signal Origin search direction 0: Forward (default setting) 1: Reverse Origin search preset (See note.) 0: Not Set (default setting) 1: Set
d+2	0 (fixed)	0	0	0 (fixed)	0 (fixed)	Encoder type	0: Incremental encoder (default setting) 1: Absolute encoder

d = 1860 hex + (Axis No. −1) × 14 hex

Note

(1) The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

(2) Make sure that the same direction is set for the origin search direction in the Axis Parameters and *Zero Point Return Direction* for W-series Servo Drives (Pn816) or *Origin Return Mode Settings* for G-series Servo Drives (Pn108) in the Servo Parameters. Setting different directions may result in a malfunction.

(3) When using an absolute encoder, make sure that the settings for the encoder type in the Axis Parameters and *Operation Switch when Using Absolute Encoder* (Pn002.2 for W Series and Pn00B for G Series) in the Servo Parameters match. If the settings do not match, ORIGIN SEARCH execution will not be possible, or another malfunction may occur.

(4) Make sure that the external input signals for origin searches (limit input signal and origin proximity input signal) maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width

is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

Axis Parameter Area Encoder type	G-series Servo Parameter Pn00B (Operation Switch when Using Absolute Encoder)	
	0: Use as an absolute encoder. 2: Use as an absolute encoder but ignore absolute multi-turn counter overflow alarm	1: Use as an incremental encoder.
0: Incremental encoder	Do not set this combination.	This setting is used when using an absolute encoder as an incremental encoder.
1: Absolute encoder	This setting is used when using an absolute encoder as an absolute encoder.	Do not set this combination.

Axis Parameter Area Encoder type	W-series Servo Parameter Pn002.2 (Operation switch when using absolute encoder)	
	0: Use as absolute encoder.	1: Use as incremental encoder.
0: Incremental encoder	Do not set this combination.	This setting is used when using an absolute encoder as an incremental encoder.
1: Absolute encoder	This setting is used when using an absolute encoder as an absolute encoder.	Do not set this combination.

When using a G-series incremental encoder, only the encoder type setting in the Axis Parameters is required (the Pn00B setting in Servo Parameters is disabled when an incremental encoder is used).

When using a W-series incremental encoder, only the encoder type setting in the Axis Parameters is required (the Pn002.2 setting in Servo Parameters is disabled when an incremental encoder is used).

An absolute encoder cannot be used with a SMARTSTEP Junior Servo Drive, and Pn002.2 is not supported. Use the Servo Drive as if the axis parameters are set for an incremental encoder.

Origin Input Signal Parameters

PCU's address	Contents		Setting
	Bits 15 to 08	Bits 07 to 00	
d	Origin input signal selection	Interrupt input signal selection	Origin input signal selection 00: Phase Z (default setting) 01: External latch signal 1 input 02: External latch signal 2 input 03: External latch signal 3 input

d = 1860 hex + (Axis No. −1) × 14 hex

Use this parameter to select the origin input signal to be used with origin search. When external latch signals 1 to 3 are used as the origin input signal, the external latch signal used must be allocated in the Servo Drive's external input allocations.

When using a SMARTSTEP Junior Servo Drive, only the Z phase or the external latch signal 1 input can be set for the origin input signal.

Servo Parameters G-series Limit Input Operation Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn066	Stop selection for drive prohibition input	---	0 to 2	2	0
---	Pn06E	Emergency stop torque	%	0 to 500	2	0

W-series Limit Input Operation Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
---	Pn001.1	Function selection application switch 1 Select stop when prohibited drive is input	---	0 to 2	2	0	Supported	Not supported
---	Pn406	Emergency stop torque	%	0 to 800	2	350	Supported	Not supported

Note The Pn406 default setting corresponds to that used for W-series Servo Drives.

The stop operation (Pn066 for G Series and Pn001.1 for W Series) sets the stop operation of the Servomotor for forward/reverse rotation limit inputs when prohibited drive is input.

When reversal mode is used for the origin search, it is also used as the operation setting when limit inputs are input in the origin search direction. The parameter size for Pn001.1 for W-series Servo Drives is the value to be specified when transferring the Servo Parameter Pn001 (including Pn001.1).

The emergency stop torque (Pn06E for G Series and Pn406 for W Series) sets the stopping torque when the stop operation for limit inputs is set to 1 (decelerates to a stop at set torque or lower, and locks Servo in zero clamp mode), or 2 (decelerates to a stop at set torque or lower, and puts Servo in free run state).

When using a SMARTSTEP Junior Servo Drive, the Servomotor will decelerate to a stop with the maximum Servomotor torque and the Servo will be locked when the forward or reverse rotation limit input is received.

Parameters for Using G-series Absolute Encoders

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn00B	Operation switch when using absolute encoder	---	0 to 2	2	0

Parameters for Using W-series Absolute Encoders

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
---	Pn002.2	Function selection application switch 2 Operation switch when using absolute encoder	---	0, 1	2	0	Supported	Not supported

When using a Servomotor with absolute encoder, select whether the absolute encoder will be used as an absolute encoder or as an incremental encoder. These parameter settings are disabled if a Servomotor with incremental encoder is used.

Set this parameter to 1 or 2 for a G-series Servo Drive, and 1 for a W-series Servo Drive, if using a Servomotor with absolute encoder as a Servomotor with incremental encoder.

When using an absolute encoder, make sure that the settings for the encoder type in the Axis Parameters and *Operation Switch when Using Absolute Encoder* (Pn00B for G Series and Pn002.2 for W Series) in the Servo Parameters match.

A motor with an absolute encoder cannot be used with a SMARTSTEP Junior Servo Drive. When using a SMARTSTEP Junior Servo Drive, Pn002.2 is not supported. Use the Servo Drive as for an incremental encoder.

If the settings do not agree, origin searches may not be possible and other malfunctions may occur.

Command Unit Parameters

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn205	Electronic gear ratio 1 (numerator)	---	1 to 1073741824	4	1
	Pn206	Electronic gear ratio 2 (denominator)	---	1 to 1073741824	4	1
R88D-WT□	Pn202	Electronic gear ratio G1 (numerator)	---	1 to 65535	2	4
	Pn203	Electronic gear ratio G2 (denominator)	---	1 to 65535	2	1
R88D-WN□-ML2	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	4
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
SMART-STEP Junior	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1

The command unit default setting is pulses.

G-series Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
Acceleration/deceleration filters	Pn10E	Moving average time	0.1 ms	0 to 5100	2	0

W-series and SMARTSTEP Junior Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
Acceleration/ deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
Acceleration/ deceleration filters	Pn810	Exponential acceleration/ deceleration bias	Command units/s	0 to 32767	2	0	Supported	Not supported
	Pn811	Exponential acceleration/ deceleration time constant	0.1 ms	0 to 5100	2	0	Supported	Not supported
	Pn812	Movement average time	0.1 ms	0 to 5100	2	0	Supported	Not supported

When using W-series Servo Drives, the first-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. When using an exponential curve for the acceleration/deceleration curve, Pn810 and Pn811 must be set for W-series Servo Drives. *Movement Average Time* for W-series Servo Drives (Pn812) or *Moving Average Time* for G-series Servo Drives (Pn10E) must be set when using an S-curve for the acceleration/deceleration curve.

The second-step acceleration/deceleration constant cannot be set using a G-series Servo Drive. The exponential acceleration/deceleration filter cannot be set because there is no exponential acceleration/deceleration filter function.

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

G-series Origin Search Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn203 (See note.)	Final distance for external input positioning	Command unit	–1,073,741,823 to 1,073,741,823	4	100
	Pn10F	Origin return mode settings	---	0000 hex or 0001 hex	2	0
	Pn110	Origin return approach speed 1	100 command units/s	1 to 32767	2	50
	Pn111	Origin return approach speed 2	100 command units/s	1 to 32767	2	5
	Pn204	Origin return final distance	Command unit	–1,073,741,823 to 1,073,741,823	1	100

W-series Origin Search Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn814 (See note.)	Final travel distance for external positioning	Command unit	–1,073,741,823 to 1,073,741,823	4	100
	Pn816	Zero point return direction	---	0000 hex or 0001 hex	2	0
	Pn817	Zero point return approach speed 1	100 command units/s	0 to 65535	2	50
	Pn818	Zero point return approach speed 2	100 command units/s	0 to 65535	2	5
	Pn819	Final travel distance to return to zero point	Command unit	–1,073,741,823 to 1,073,741,823	4	100

Note When using a Position Control Unit with unit version 2.0 or later, the *Final Distance for External Input Positioning* for G-series Servo Drives (Pn203) or *Final Travel Distance for External Positioning* for W-series Servo Drives (Pn814) is used for internal processing in the Position Control Unit for either of the following origin search operation patterns.

- When the origin detection method is set to any value except for 0 (Origin proximity input signal reversal)
- When setting a zero point position offset for an origin search using an absolute encoder

The *Final Distance for External Input Positioning* for G-series Servo Drives (Pn203) or *Final Travel Distance for External Positioning* for W-series Servo Drives (Pn814) is automatically overwritten by the Position Control Unit when the origin search operation is started. If interrupt feeding is used after the origin search, the *Final Distance for External Input Positioning* for G-series Servo Drives (Pn203) or *Final Travel Distance for External Positioning* for W-series Servo Drives (Pn814) must be reset. Also, the Servo parameters are read out by the Position Control Unit for the following parameters when the origin search operation is started.

Origin Return Approach Speed 1, Origin Return Approach Speed 2, Origin Return Final Distance (Pn110, Pn111, and Pn204) for G Series or *Zero Point Return Approach Speed 1*, *Zero Point Return Approach Speed 2*, and *Final Travel Distance to Return to Zero Point* (Pn817, Pn818, and Pn819) for W Series)

Absolute Origin Offset (Pn200) for G Series or *Absolute Encoder Zero Point Position Offset* (Pn808) for W Series) (when using an absolute encoder)

Make sure that the same direction is set for Origin Search Direction in the Axis Parameters and *Origin Return Mode Settings* for G-series Servo Drives (Pn10F) or *Zero Point Return Mode Setting* for W-series Servo Drives (Pn816) in the Servo Parameters. Setting different directions may result in a malfunction.

Control Status Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn060	Positioning completion range 1	Command unit	0 to 10000	2	25
	Pn105	Origin range	Command unit	0 to 250	2	10
R88D-WT□	Pn500	Positioning completion range 1	Command unit	0 to 250	2	3
	Pn803	Zero point width	Command unit	0 to 250	2	10
R88D-WN□-ML2	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	3
	Pn803	Zero point width	Command unit	0 to 250	2	10
SMART-STEP Junior	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	10
	Pn523	Zero point width	Command unit	0 to 250	2	10

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
ORIGIN SEARCH	a	06	0 → 1: Starts origin search	Supported	Supported	Supported
Position command value	a+2 a+3	---	Position command value (rightmost word) Position command value (leftmost word) Unit: Command units/s Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex) This value is also used as the preset value when a preset value is being set after completing an origin search.	Supported	Not supported	Supported
Speed command value	a+4 a+5	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 1 to 2,147,483,647 (00000001 hex to 7FFFFFFF hex) This value is also used as the preset value when a preset value is being set after completing an origin search.	Supported	Supported	Supported

Name		Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
Acceleration/ deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/ deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/ deceleration curve.	Supported	Supported	Not supported
Forward rotation current limit			14	1: Use forward torque limit	Supported	Supported	Not supported
Reverse rotation current limit			15	1: Use reverse torque limit	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The speed command value specifies the initial origin search speed until the origin proximity signal is input. When an origin search is started with the speed command set to 0 (command units/s), a Speed Designation Error (axis error code: 3061) will occur and the origin search will not be executed.

Torque limit during operation is possible with origin searches. For further details on the torque limit function, refer to *10-4 Torque Limits*.

The speed command value, acceleration/deceleration curve designation, and forward/reverse rotation current limit designation data are enabled when the ORIGIN SEARCH Bit turns ON.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Drive, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

Note Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

Axis Operating Input Memory Areas (Monitor)

Name	Word	Bits	Contents
PCU Positioning Completed Flag	b	05	0 → 1: Positioning completed.
No Origin Flag		06	0: Origin established. 1: No origin established.
Origin Stop Flag		07	0: Outside origin range. 1: Within origin range.
Error Flag		12	0: No axis error. 1: Axis error.
Busy Flag		13	1: Axis busy (axis operation executing)
Feedback present position	b+6 b+7	---	Present position: Feedback position (rightmost word) Feedback position (leftmost word)
Command present position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

8-2-4 Origin Search Operation

Origin Search Operation Summary

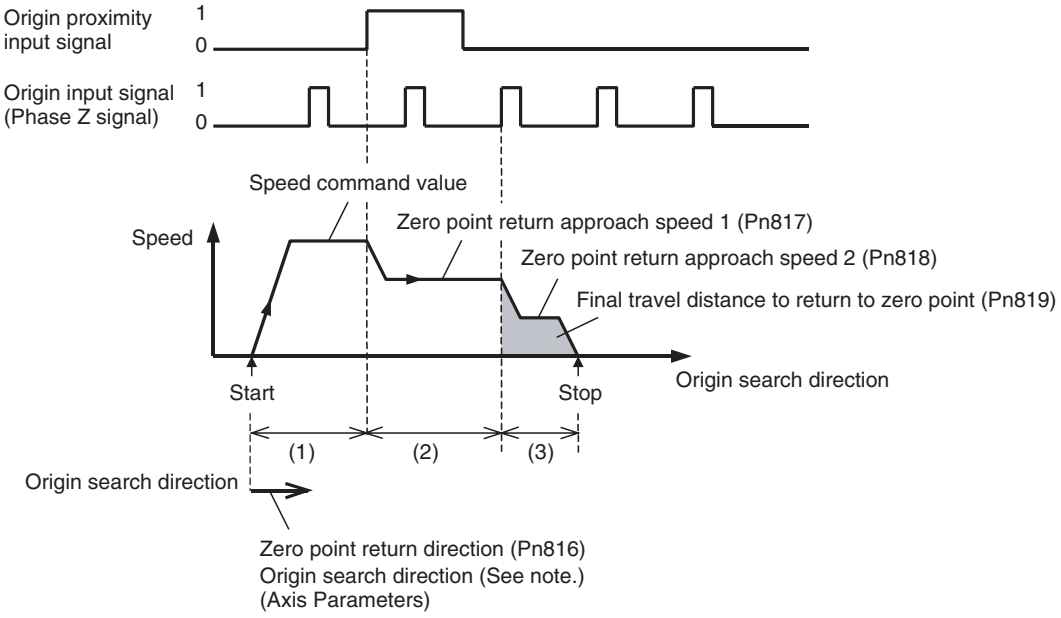
Basically, the PCU's origin search operation consists of the following three steps.

1,2,3...

1. Search for origin proximity signal
2. Search for origin signal after detection of origin proximity signal
3. Positioning for final travel distance to return to zero point after detection of origin signal

Each of these steps is executed using the operation direction and speed according to the Axis Parameters, Servo Parameters, and speed command value for origin search as shown in the following diagram.

The origin proximity signal is not always used in the origin search operation pattern and an origin search can be started at the zero point return approach speed. For details on origin search operation patterns, refer to *Origin Search Operation Modes* on page 287.



Note

(1) The operation direction for origin search is determined by the setting in Servo Parameter *Zero Point Return Direction* (Pn816).

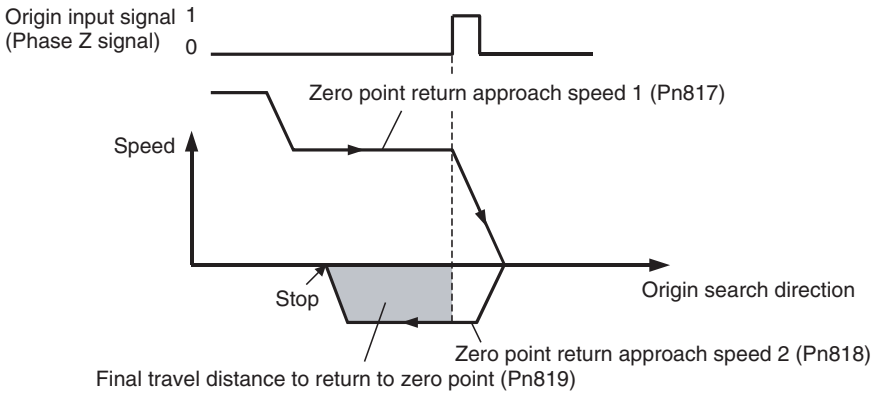
(2) The parameters shown above are different for G-series Servo Drives.

(3) Make sure that the same direction is set for *Origin Search Direction* in the Axis Parameters and *Zero Point Return Direction* (Pn816) in the Servo Parameters. Setting different directions may result in a malfunction.

The override function is disabled during origin searches.

The parameter *Final Travel Distance to Return to Zero Point* (Pn819) sets the amount of compensation positioning used after the origin input signal has been detected. The value is set as the relative travel distance in the origin search direction.

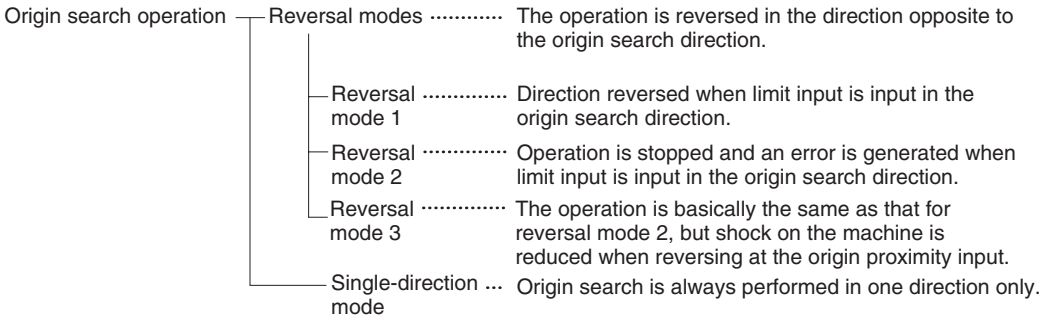
When *Final Travel Distance to Return to Zero Point* (Pn819) is set to a negative or small value, the axis will decelerate to a stop, and then reverse and perform the set positioning.



For details on the acceleration/deceleration operation during origin search, refer to *7-4 Acceleration and Deceleration Operations*.

Origin Search Operation Modes

The following four modes are available for origin search operation.


Origin search operation
Reversal modes ..... The operation is reversed in the direction opposite to the origin search direction.
Reversal mode 1 ..... Direction reversed when limit input is input in the origin search direction.
Reversal mode 2 ..... Operation is stopped and an error is generated when limit input is input in the origin search direction.
Reversal mode 3 ..... The operation is basically the same as that for reversal mode 2, but shock on the machine is reduced when reversing at the origin proximity input.
Single-direction mode ... Origin search is always performed in one direction only.

Note The parameter numbers shown above are different for G-series Servo Drives.

Select the origin search operation by setting *Origin Search Operation* in the Axis Parameters.

0: Reversal mode 1
1: Reversal mode 2
2: Single-direction mode
3: Reversal mode 3 (Can be used only for Position Control Units with unit version 2.0 or later.)

Origin Detection method

The Origin Detection Method parameter determines how the origin proximity input signal is used. Any of the following three patterns can be selected in the Axis Parameters.

Setting	Origin detection method	Origin input signal detection	Remarks
0	With origin proximity input signal reversal	The origin input signal is detected after the origin proximity input signal turns ON and then OFF.	---

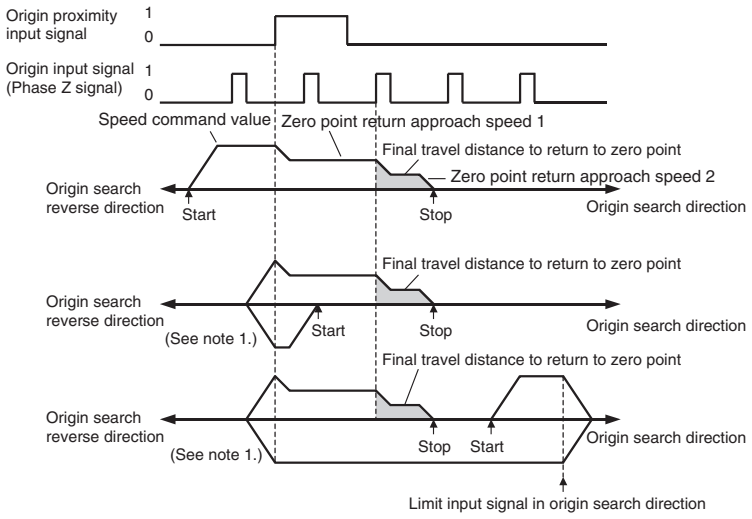
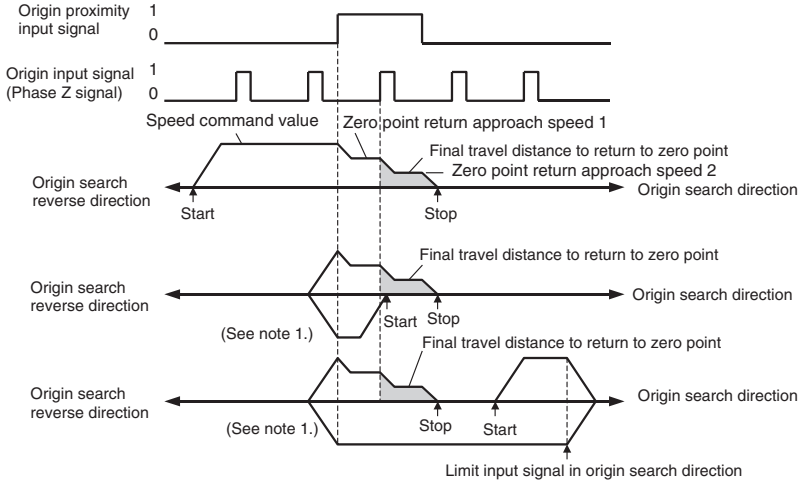
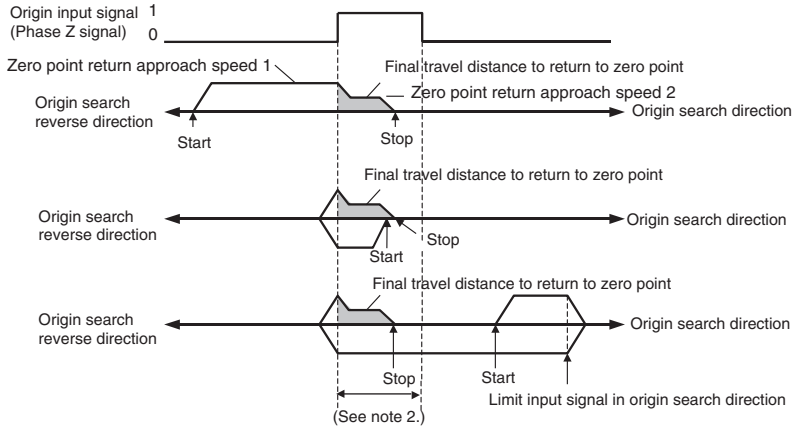
Setting	Origin detection method	Origin input signal detection	Remarks
1	Without origin proximity input signal reversal	The origin input signal is detected after the origin proximity input signal turns ON.	This setting is possible only for Position Control Units with unit version 2.0 or later.
2	Not use origin proximity input signal	The origin proximity input signal is not used.	The origin search operation is started at the zero point return approach speed 1. If this setting is used along with reversal mode 3, and axis parameter check error (error code: 3091) will occur when the data is transferred. This setting is possible only for Position Control Units with unit version 2.0 or later.

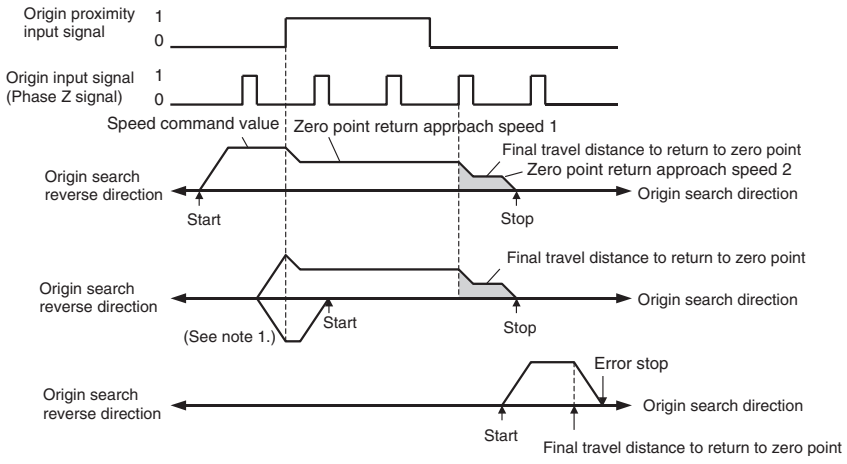
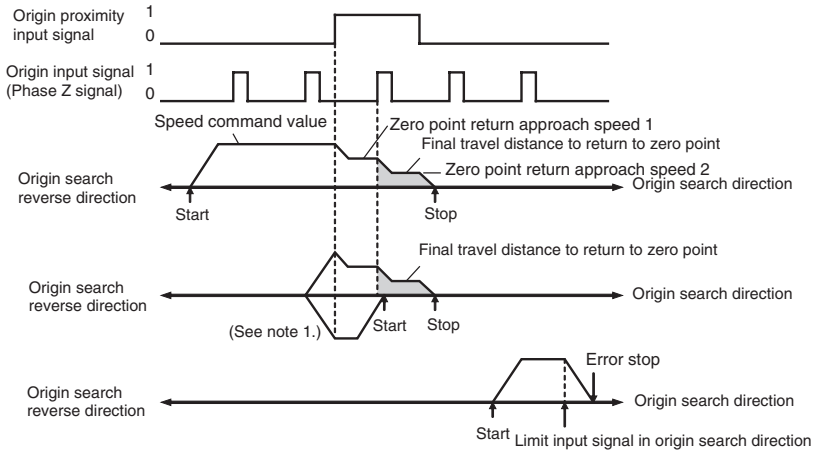
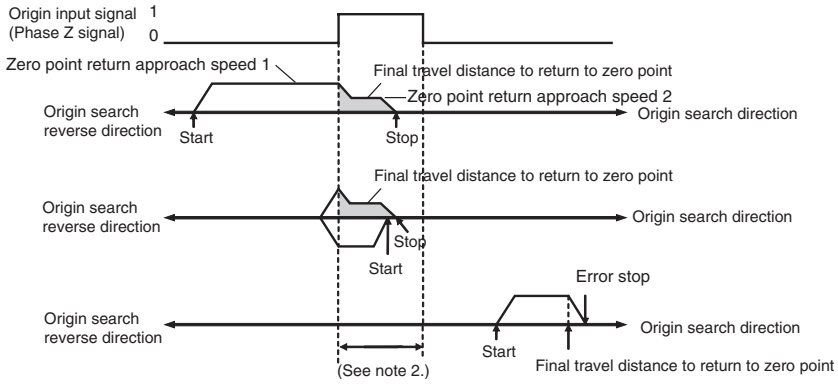
Note

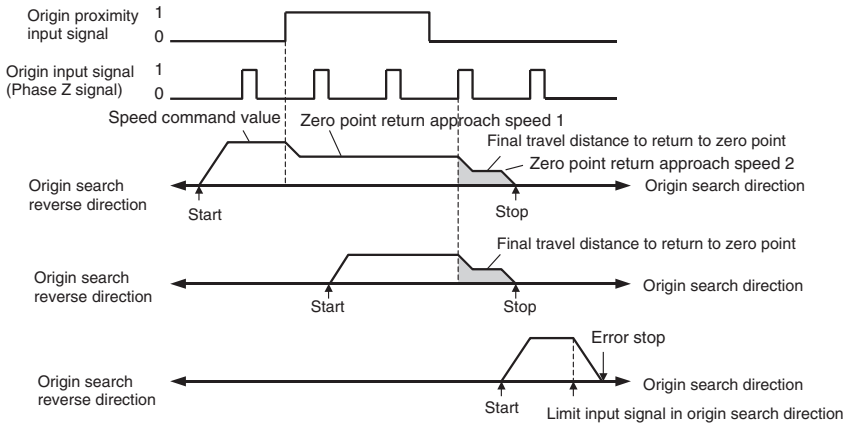
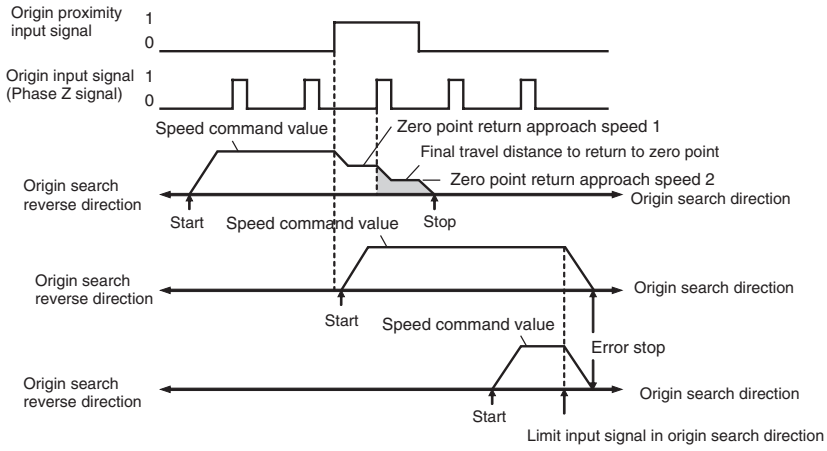
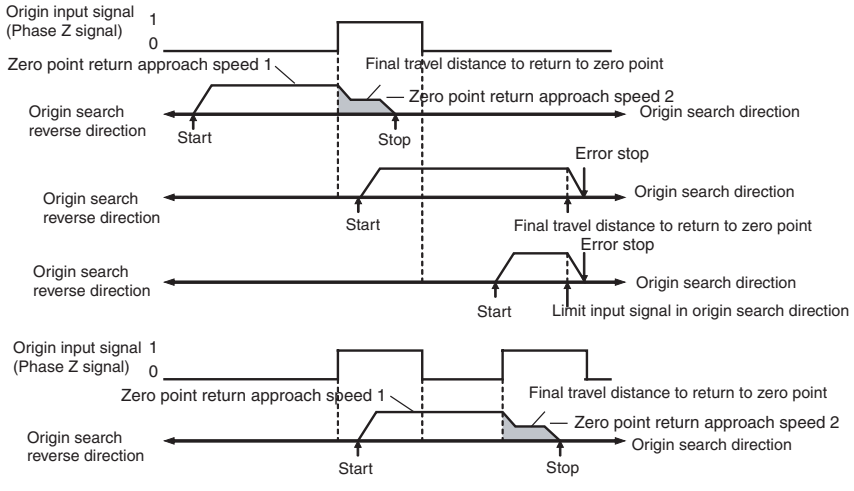
(1) The Servo Drive's origin proximity input signal (origin return deceleration limit switch signal) must be allocated to execute ORIGIN SEARCH. The forward/reverse rotation limit signal (forward/reverse drive prohibited signal) must be allocated to use a reversal mode. If these input signals are not allocated, ORIGIN SEARCH cannot be executed properly. For details on allocating Servo Drive input signals, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

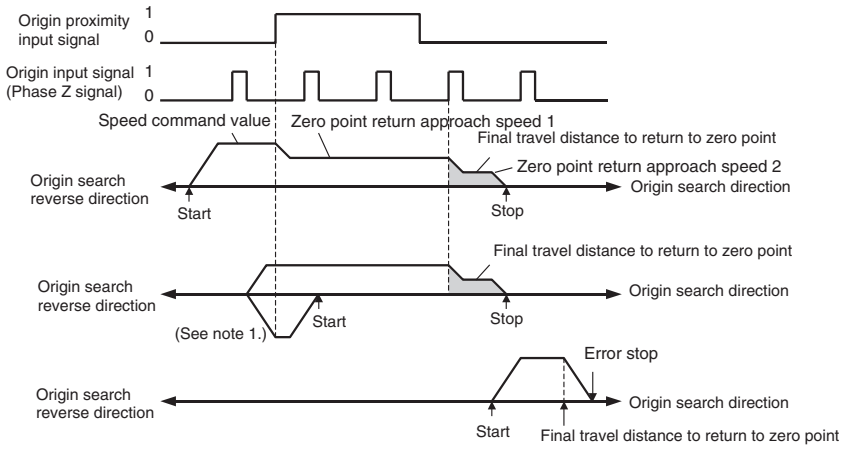
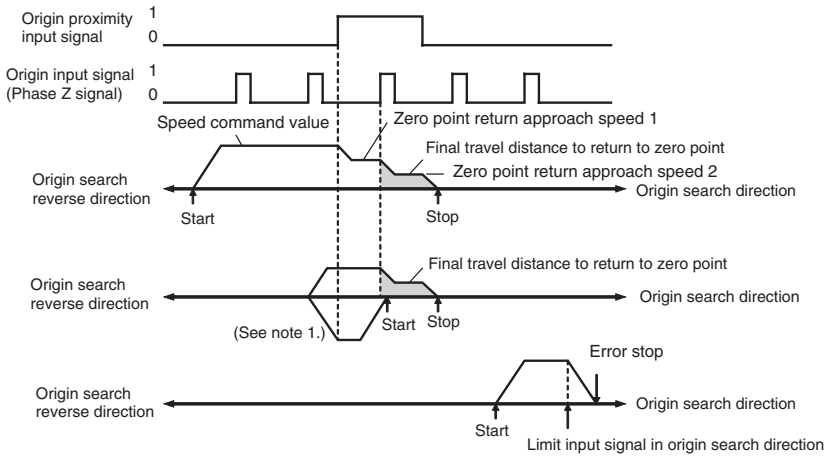
(2) Make sure that the external input signals for origin searches (limit input signal and origin proximity input signal) maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

(3) For origin searches, the origin signal is detected after the origin proximity input signal (origin return deceleration limit switch) changes from ON to OFF. Therefore, be sure to use a sensor for the origin proximity input signal, such as a photoelectric switch, that does not produce chattering. Chattering from contact switches may result in the displacement of the origin position.

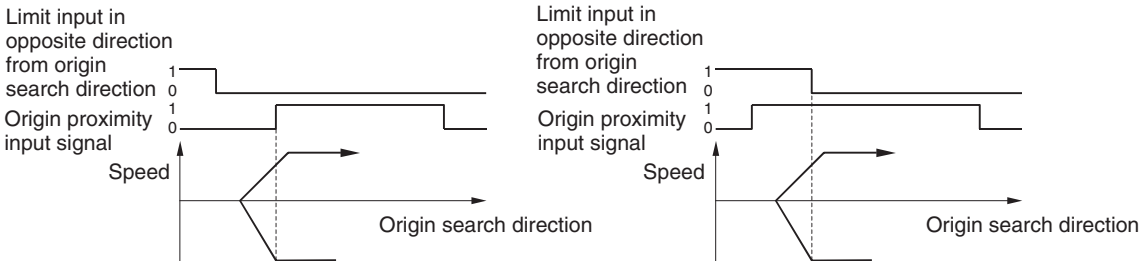
Origin search operation mode	**0: Reversal mode 1**
Origin detection method	
0: With origin proximity input signal reversal	
1: Without origin proximity input signal reversal (unit version 2.0 or later)	
2: Not use origin proximity input signal (unit version 2.0 or later)	

Origin search operation mode	1: Reversal mode 2
Origin detection method	
0: With origin proximity input signal reversal	
1: Without origin proximity input signal reversal (unit version 2.0 or later)	
2: Not use origin proximity input signal (unit version 2.0 or later)	

Origin search operation mode	**2: Single-direction mode**
Origin detection method	
0: With origin proximity input signal reversal	
1: Without origin proximity input signal reversal (unit version 2.0 or later)	
2: Not use origin proximity input signal (unit version 2.0 or later)	

Origin search operation mode / **Origin detection method**	**3: Reversal mode 2 (unit version 2.0 or later)**
0: With origin proximity input signal reversal	
1: Without origin proximity input signal reversal (unit version 2.0 or later)	
2: Not use origin proximity input signal (unit version 2.0 or later)	Cannot be set. (An axis parameter check error (error code: 3091) will occur when the data is transferred.)

Note (1) The reversal operation for an origin search in the reverse direction is executed either when the origin proximity input signal turns OFF during the origin search in the reverse direction, or when the limit input signal turns ON during the origin search in the reverse direction while the origin proximity input signal is ON, whichever occurs first.



(2) The signal width of the origin input signal must be longer than the MECHATROLINK communications cycle when the Origin Proximity Input Signal parameter is set to 2 (Not use origin proximity input signal) during

the origin search for the Reversal Mode 1 and Reversal Mode 2 origin search operation modes. If the origin input signal length is shorter than the communications cycle, the PCU will be unable to detect the origin input signal when in reversal operation. If the established origin position is not aligned, the origin search function will not operate correctly. If using this function with this setting, use an external sensor for the origin input signal or select an origin search method that uses the origin proximity input signal because the signal width of the Servo Drive's Z-phase signal is too short.

Reversal Mode Operation Using Limit Inputs

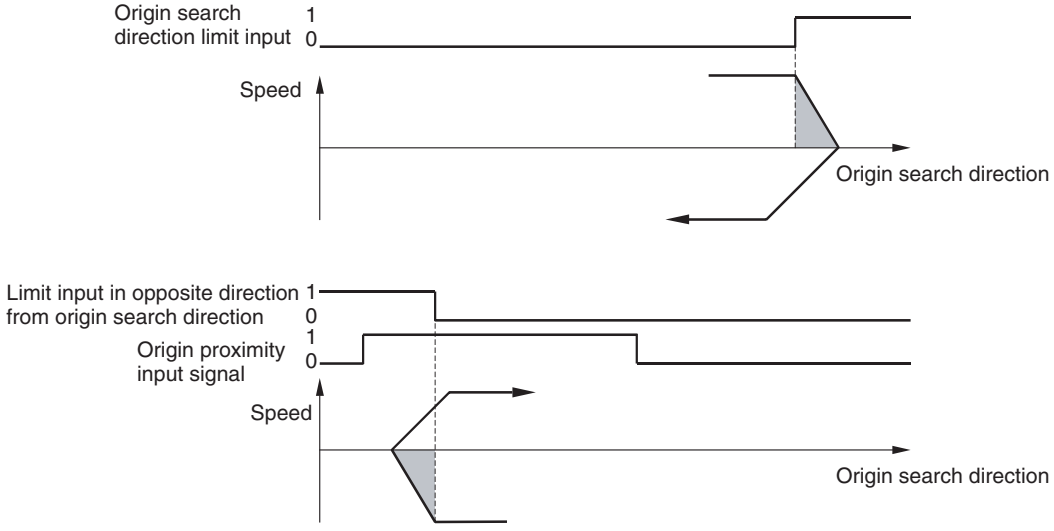
When the origin search operation mode is set to reversal mode 1 to 3, axis operation stops or changes to the opposite direction when the limit input signal turns ON.

When using a W-series Servo Drive, the axis will operate according to the *Select Stop when Prohibited Drive Is Input* (Pn001.1) setting in the Servo Parameters after the limit input signal turns ON and until the axis operation stops.

When using a SMARTSTEP Junior Servo Drive, the Servomotor will decelerate to a stop using the maximum Servomotor torque.

Reverse Pattern

For reversal mode 1, the positioning relationship between the limit input and the origin proximity signal is as shown by the two patterns in the following diagram. For reversal mode 2 or 3, only the bottom pattern is possible. When these modes are used, the axis operates according to the *Stop Selection for Drive Prohibit Input* for G-series Servo Drives (Pn066) or *Select Stop when Prohibited Drive Is Input* for W-series Servo Drives (Pn001.1) for the shaded areas in the diagram.



Note If the Servo Parameter (Pn066 for G Series and Pn001.1 for W Series) is set to stop operation with a free run when a limit input is input when using a G-series or a W-series Servo Drive, the momentum of the previous operation may cause the machine to run in the limit input direction. When origin searches are performed using reversal mode 1 to 3 as the operation mode, either enable the Servo Drive's dynamic brake, or set the *Stop Selection for Drive Prohibit Input* for G-series Servo Drives (Pn066) or *Select Stop when Prohibited Drive Is Input* for W-series Servo Drives (Pn001.1) to 1 (decelerates to a stop using the emergency stop torque set in Pn06E for G Series or Pn406 for W Series or lower and locks Servo in zero clamp mode) or 2 (decel-

erates to a stop using the emergency stop torque set in Pn06E for G Series or Pn406 for W Series or lower and puts Servo in free run state) so that the Servomotor stops properly when a limit input is received.

8-2-5 Starting Origin Search

Origin search is performed according to the speed command value set in the Axis Operating Output Memory Areas and started when the ORIGIN SEARCH Bit turns ON. Execute ORIGIN SEARCH when the Busy Flag for the corresponding axis is OFF. If ORIGIN SEARCH is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and ORIGIN SEARCH will not be executed.

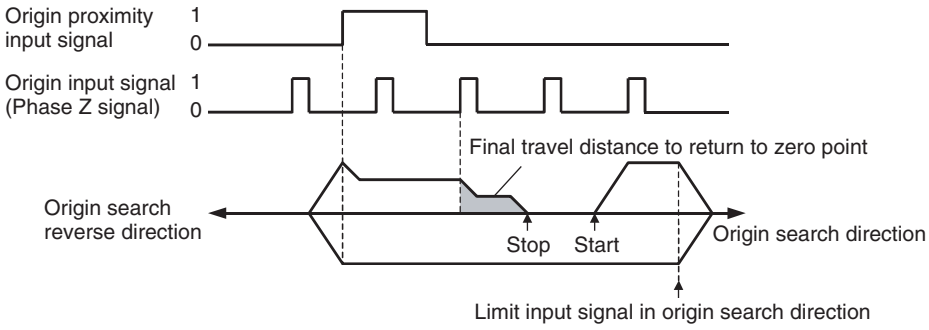
When starting ORIGIN SEARCH, make sure that the ORIGIN SEARCH Bit will remain ON until the Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the ORIGIN SEARCH command will be ignored. Be sure that all of these command bits are OFF before executing an origin search.

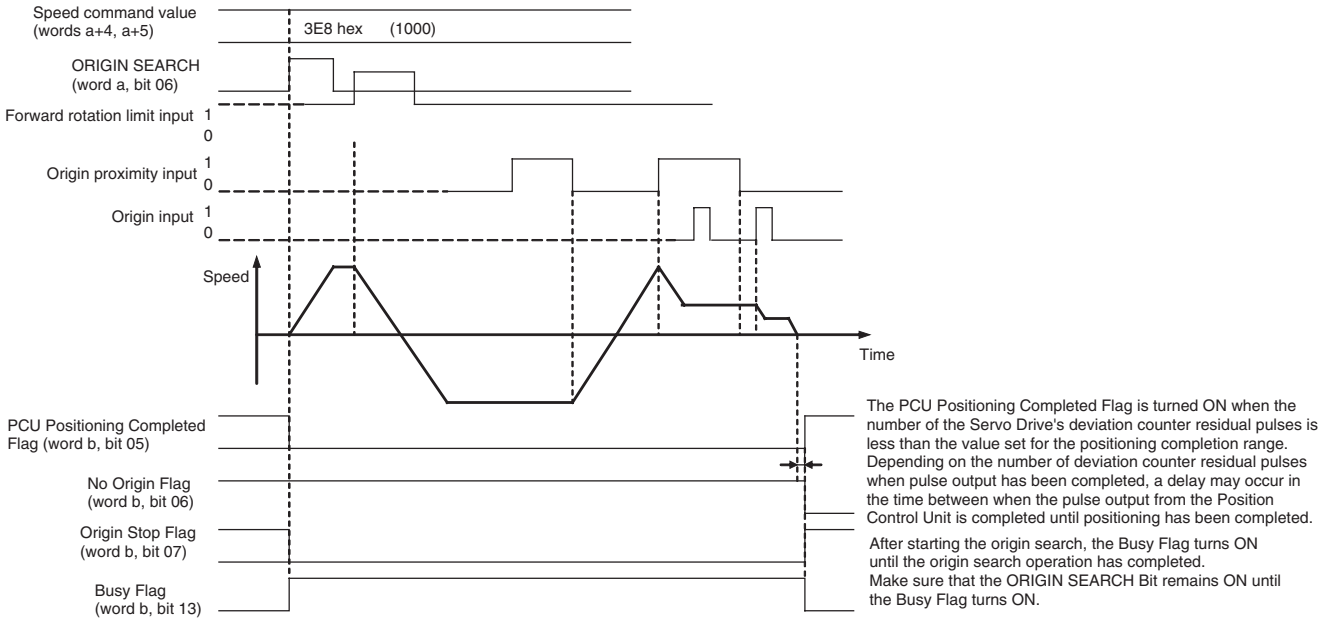
Timing Chart

The following timing charts are for when ORIGIN SEARCH is executed with the origin search operation set to reversal mode 1, the origin detection mode set to origin proximity input signal reversal, and the origin search direction set to forward.

Timing Chart Operation



Timing Chart


Speed command value
(words a+4, a+5)
3E8 hex (1000)
ORIGIN SEARCH
(word a, bit 06)
Forward rotation limit input
Origin proximity input
Origin input
Speed
Time
PCU Positioning Completed
Flag (word b, bit 05)
No Origin Flag
(word b, bit 06)
Origin Stop Flag
(word b, bit 07)
Busy Flag
(word b, bit 13)
The PCU Positioning Completed Flag is turned ON when the number of the Servo Drive's deviation counter residual pulses is less than the value set for the positioning completion range. Depending on the number of deviation counter residual pulses when pulse output has been completed, a delay may occur in the time between when the pulse output from the Position Control Unit is completed until positioning has been completed.
After starting the origin search, the Busy Flag turns ON until the origin search operation has completed.
Make sure that the ORIGIN SEARCH Bit remains ON until the Busy Flag turns ON.

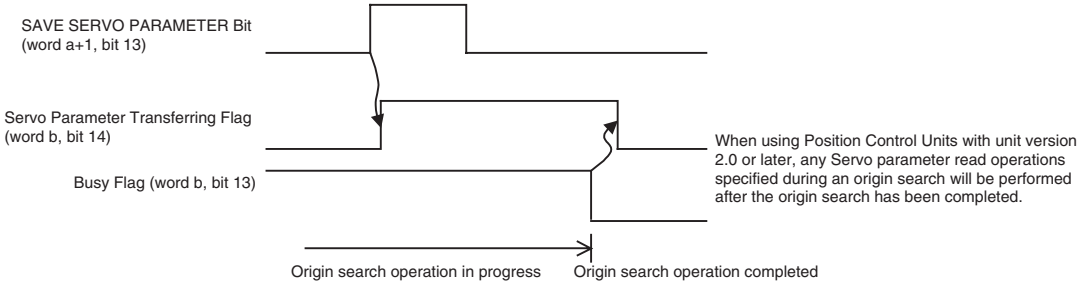
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Note If the origin search preset is used, the PCU Positioning Completed Flag, No Origin Flag, and Busy Flag will change status only after the present position preset operation is completed after finishing the origin search operation.

Transferring Parameters during Origin Search Operations

The Position Control Unit can transfer Servo Parameters during axis operations (i.e., while the Busy Flag is ON). With Position Control Units with unit version 2.0 or later, Servo Parameter transfers specified during origin search operation are performed after completing the origin search.

Example: The following example illustrates reading Servo Parameters during an origin search operation.


SAVE SERVO PARAMETER Bit
(word a+1, bit 13)
Servo Parameter Transferring Flag
(word b, bit 14)
Busy Flag (word b, bit 13)
When using Position Control Units with unit version 2.0 or later, any Servo parameter read operations specified during an origin search will be performed after the origin search has been completed.
Origin search operation in progress
Origin search operation completed

8-2-6 Origin Search Preset

The present position can be set to any desired position after completing an origin search. This enables setting an arbitrary electrical origin point corresponding to the mechanical origin point.

This function can be used only with Position Control Units with unit version 2.0 or later.

The origin search preset operation is selected using the following Origin Search Preset parameter in the Axis Parameters.

Axis Parameters

The following parameters are used to set the origin search operation mode.

PCU's address	Contents						Setting
	15 to 14	13	12	11 to 08	07 to 04	03 to 00	
d+1	0 (fixed)	Origin search preset	Origin search direction	Origin detection method	Origin search operation	0 (fixed)	Bit 13: Origin Search Preset 0: Do not set the present position to the preset position after completing the origin search (default setting). 1: Set the present position to the preset position after completing the origin search.

d = 1860 hex + (Axis No. −1) × 14 hex

The position command value set in the Axis Operating Output Memory Areas is used as the preset value to be set after completing an origin search.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
Position command value	a+2 a+3	---	Position command value (rightmost word) Position command value (leftmost word) Unit: Command units/s Command range: −2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex) This value is also used as the preset value when a preset value is being set after completing an origin search.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The position command value that is set when the ORIGIN SEARCH command bit turns ON is used as the origin search preset.

The origin search preset operation is executed only after the origin search operation has been completed normally, i.e., when positioning for the final travel distance to return to zero point has entered the positioning completion range after the origin signal has been detected.

If an absolute encoder is used, the origin search operation is set to reversal mode 1, and the origin search preset is enabled, a zero point position offset for the absolute encoder can be automatically set. Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details.

Note The origin search preset function of the Position Control Unit cannot be used with the function block for origin searches in the OMRON FB Library (_NCF05□_Home) if the Library is version is 1.13 or lower. Use the present value preset function provided in the library. To use the origin search function block and enable the origin search preset, the OMRON FB Library with a version higher than 1.13 must be used.

8-3 Present Position Preset

PRESENT POSITION PRESET changes the present position to any position and then establishes the origin.

8-3-1 Outline of Operation

When the PRESENT POSITION PRESET Bit is turned ON, the present position is changed to the value set as the position command value in the Axis Operating Output Memory Areas. during present position preset, the Busy Flag is ON (1 cycle time min.). The Busy Flag turns OFF to indicate that preset operation has been completed. After this, the origin is established. If the present position is changed to "0," then that position will become the origin.

8-3-2 Data Settings for Present Position Preset

A simple explanation of the main parameters and data used to execute PRESENT POSITION PRESET is provided here. For details on command units, refer to *7-2 Control Units*.

The setting units for parameters and data depend on the specified command unit.

Servo Parameter Area Command Unit Parameters

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn205	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn206	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
R88D-WT□	Pn202	Electronic gear ratio G1 (numerator)	---	1 to 65535	2	4
	Pn203	Electronic gear ratio G2 (denominator)	---	1 to 65535	2	1
R88D-WN□-ML2	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	4
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
SMART-STEP Junior	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1

The command unit default setting is pulses.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
PRESENT POSITION PRESET	a	08	0 → 1: Starts present position preset
Position command value	a+2 a+3	---	Position command value (rightmost word) Position command value (leftmost word) Unit: Command unit Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex)

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

Present position preset is performed according to the position command value set in the Axis Operating Output Memory Area and started when the PRESENT POSITION PRESET Bit turns ON.

Execute PRESENT POSITION PRESET when the Busy Flag for the corresponding axis is OFF. If PRESENT POSITION PRESET is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and PRESENT POSITION PRESET will not be executed. When executing PRESENT POSITION PRESET, make sure that the PRESENT POSITION PRESET Bit will remain ON until the Busy Flag turns ON.

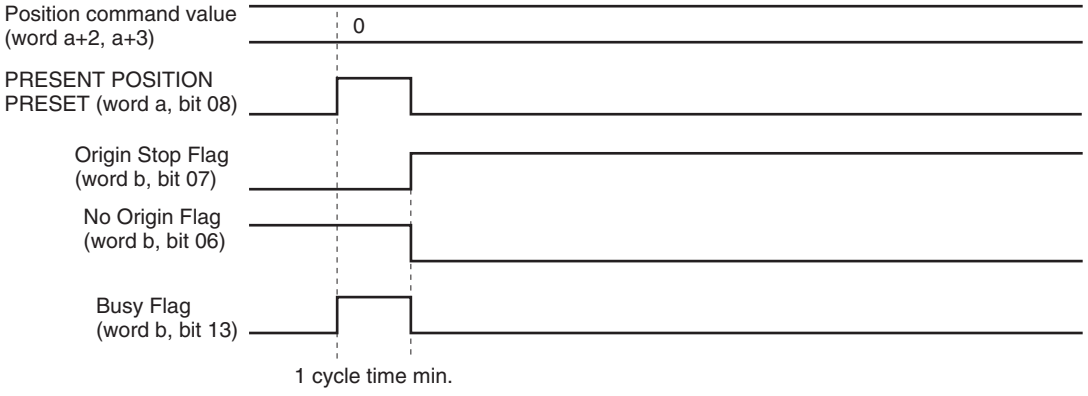
Axis Operating Input Memory Areas (Monitor)

Name	Word	Bits	Contents
No Origin Flag	b	06	0: Origin established. 1: No origin established.
Origin Stop Flag		07	0: Outside origin range. 1: Within origin range.
Error Flag		12	0: No axis error. 1: Axis error.
Busy Flag		13	1: Axis busy (axis operation executing).
Feedback present position	b+6 b+7	---	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
Command present position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart

In the following timing chart, the present position is changed to “0.” When the present position changes to “0,” that position becomes the origin, so the Origin Stop Flag turns ON. The status of the PCU Positioning Completed Flag (word b, bit 05) does not change.



a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

8-4 Origin Return

The origin return operation is used to return the axis to the origin from any position. ORIGIN RETURN is executed when the ORIGIN RETURN Bit turns ON.

Note Execute ORIGIN RETURN when the origin has been established. If ORIGIN RETURN is executed when the origin has not been established, a Present Position Unknown Error (axis error code: 3030) will occur.

8-4-1 Origin Return Data Settings

A simple explanation of the main parameters and data used to execute ORIGIN RETURN is provided here. To execute ORIGIN RETURN, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

For details on command units, refer to *7-2 Control Units*. The setting units for parameters and data depend on the specified command unit.

Servo Parameter Area Command Unit Parameters

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn205	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn206	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
R88D-WT□	Pn202	Electronic gear ratio G1 (numerator)	---	1 to 65535	2	4
	Pn203	Electronic gear ratio G2 (denominator)	---	1 to 65535	2	1
R88D-WN□-ML2	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	4
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1
SMART-STEP Junior	Pn20E	Electronic gear ratio G1 (numerator)	---	1 to 1073741824	4	1
	Pn210	Electronic gear ratio G2 (denominator)	---	1 to 1073741824	4	1

The command unit default setting is pulses.

G-series Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
Acceleration/deceleration filters	Pn10E	Moving average time	0.1 ms	0 to 5100	2	0

W-series and SMARTSTEP Junior Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
Acceleration/deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
Acceleration/deceleration filters	Pn810	Exponential acceleration/deceleration bias	Command units/s	0 to 32767	2	0	Supported	Not supported
	Pn811	Exponential acceleration/deceleration time constant	0.1 ms	0 to 5100	2	0	Supported	Not supported
	Pn812	Movement average time	0.1 ms	0 to 5100	2	0	Supported	Not supported

When using W-series Servo Drives, the first-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. When using an exponential curve for the acceleration/deceleration curve, Pn810 and Pn811 must be set for W-series Servo Drives. *Movement Average Time* for W-series Servo Drives (Pn812) or *Moving Average Time* for G-series Servo Drives (Pn10E) must be set when using an S-curve for the acceleration/deceleration curve.

The second-step acceleration/deceleration constant cannot be set using a G-series Servo Drive. The exponential acceleration/deceleration filter cannot be set because there is no exponential acceleration/deceleration filter function.

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

Refer to *7-4 Acceleration and Deceleration Operations* for details on acceleration/deceleration curves.

Control Status Parameters

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn060	Positioning completion range 1	Command unit	0 to 10000	2	25
	Pn105	Origin range	Command unit	0 to 250	2	10
R88D-WT□	Pn500	Positioning completion range 1	Command unit	0 to 250	2	3
	Pn803	Zero point width	Command unit	0 to 250	2	10

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-WN□-ML2	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	3
	Pn803	Zero point width	Command unit	0 to 250	2	10
SMART-STEP Junior	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	10
	Pn803	Zero point width	Command unit	0 to 250	2	10

Axis Operating Output Memory Areas (Operating Commands)

Name		Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
ORIGIN RETURN Bit		a	07	0 → 1: Starts origin return operation	Supported	Supported	Supported
Speed command value		a+4 a+5	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 1 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex) The upper limit setting for the speed command value depends on the Servo Drive specifications.	Supported	Supported	Supported
Acceleration/deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/deceleration curve.	Supported	Supported	Not supported
Forward rotation current limit			14	1: Use forward torque limit	Supported	Supported	Not supported
Reverse rotation current limit			15	1: Use reverse torque limit	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Origin return is performed according to the speed command value set in the Axis Operating Output Memory Areas and started when the ORIGIN RETURN Bit turns ON.

Execute ORIGIN RETURN when the Busy Flag for the corresponding axis is OFF. If ORIGIN RETURN is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and ORIGIN RETURN will not be executed. When starting ORIGIN RETURN, make sure that the ORIGIN RETURN Bit will remain ON until the Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the ORIGIN RETURN command will be ignored. Be sure that all of these command bits are OFF before executing an origin return.

The target speed for an origin return operation can be changed while ORIGIN RETURN is being executed by setting the new speed command value in the Axis Operating Output Memory Area. (For details on changing the target speed, which is the same as positioning operations, refer to *9-4-4 Changing Target Speed*.)

Torque limit during operation is possible with origin return operations. For further details on the torque limit function, refer to *10-4 Torque Limits*.

The acceleration/deceleration curve designation, and forward/reverse rotation current limit designation data are enabled when the ORIGIN RETURN Bit turns ON.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Drive, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

Note Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

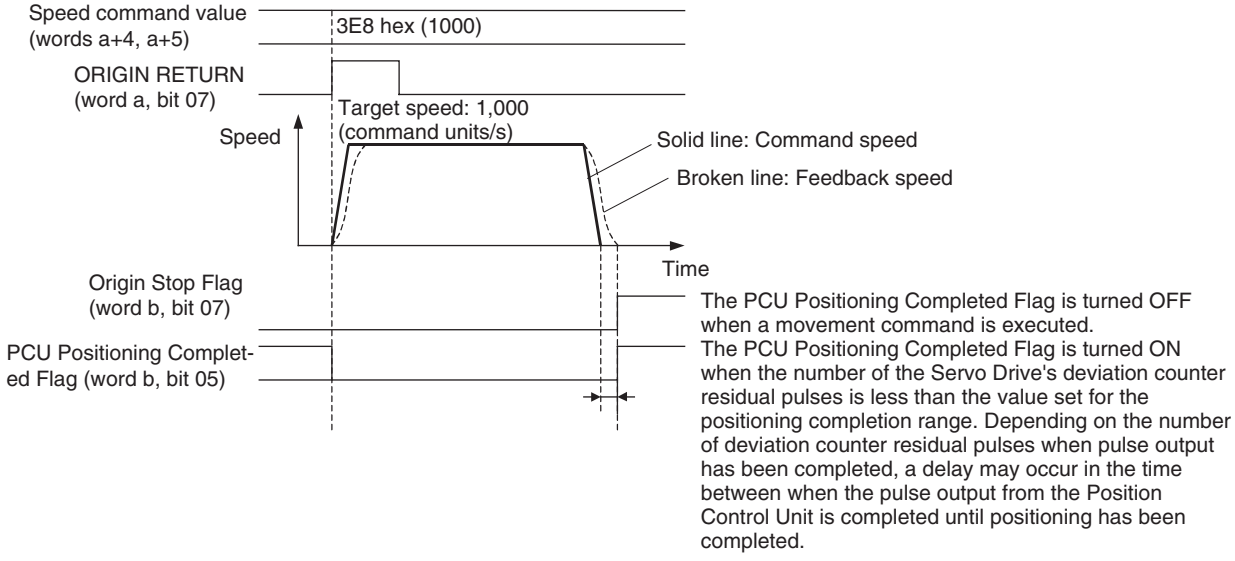
Axis Operating Input Memory Areas (Monitor)

Name	Word	Bits	Contents
PCU Positioning Completed Flag	b	05	0 → 1: Positioning completed.
No Origin Flag		06	0: Origin established. 1: No origin established.
Origin Stop Flag		07	0: Outside origin range. 1: Within origin range.
Error Flag		12	0: No axis error. 1: Axis error.
Busy Flag		13	1: Axis busy (axis operation executing).
Feedback present position	b+6 b+7	---	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
Command present position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart

The following timing chart is for when ORIGIN RETURN is executed.


Speed command value (words a+4, a+5)
3E8 hex (1000)
ORIGIN RETURN (word a, bit 07)
Target speed: 1,000 (command units/s)
Speed
Solid line: Command speed
Broken line: Feedback speed
Time
Origin Stop Flag (word b, bit 07)
PCU Positioning Completed Flag (word b, bit 05)
The PCU Positioning Completed Flag is turned OFF when a movement command is executed.
The PCU Positioning Completed Flag is turned ON when the number of the Servo Drive's deviation counter residual pulses is less than the value set for the positioning completion range. Depending on the number of deviation counter residual pulses when pulse output has been completed, a delay may occur in the time between when the pulse output from the Position Control Unit is completed until positioning has been completed.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

8-5 Phase Z Margin

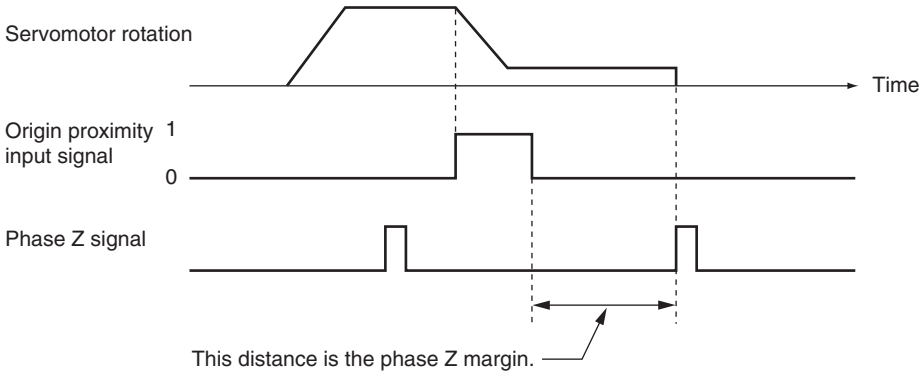
8-5-1 Description

Although there are some variations for different settings, the PCU's origin search basically works by latching (detecting) the first encoder phase Z after confirming ON/OFF status of the origin proximity signal, performing positioning for the final travel distance to return to the origin, and then setting that position as the origin.

When the time (distance) from when the origin proximity signal changes from ON to OFF until the first phase Z is detected is extremely short or is almost the same as the time taken for one rotation of the Servomotor, the position at which the phase Z is detected may be displaced by one phase due to discrepancies in the ON response of the origin proximity sensor or the Servo Drive speed. This displacement is prevented by confirming the “phase Z margin.” The phase Z margin indicates the amount by which the Servomotor rotated during the time from when the origin proximity signal changed from ON to OFF until the phase Z was detected.

If this value is close to 0 or close to one motor rotation, there is a possibility of origin displacement during origin search. A simple way of reducing the probability of this is to adjust the Servomotor's mounting angle or the origin proximity sensor's mounting position so that this value is approximately half a rotation of the Servomotor.

Example: Final travel distance to return to zero point = 0

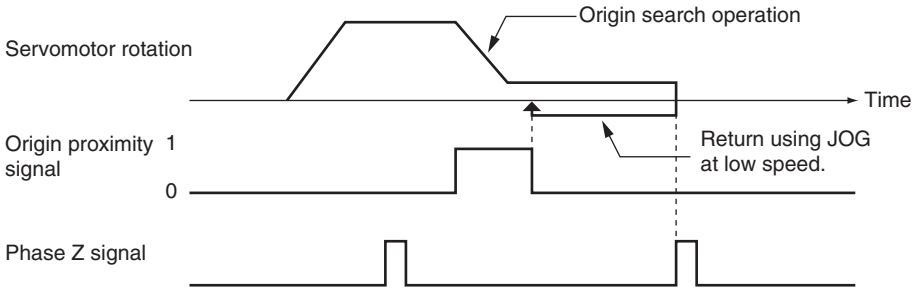


8-5-2 Calculating the Phase Z Margin (Example)

One method used to obtain the phase Z margin is to perform jogging after origin search in the opposite direction to origin search, with the final travel distance to return to origin set to 0. Then stop operation at the point where the origin proximity signal changes from OFF to ON, and read the value of the present position at that point. The value of this present position is equal to the phase Z margin.

If the speed at the point when the origin proximity signal turns ON is fast, there will be some inaccuracy in the value read for the phase Z margin. Reduce the speed of the jogging in the vicinity of the point where the origin proximity signal turns ON.

The required phase Z margin can be obtained by adjusting mounting positions and angles so that this position corresponds to approximately half the distance moved for one rotation of the motor.



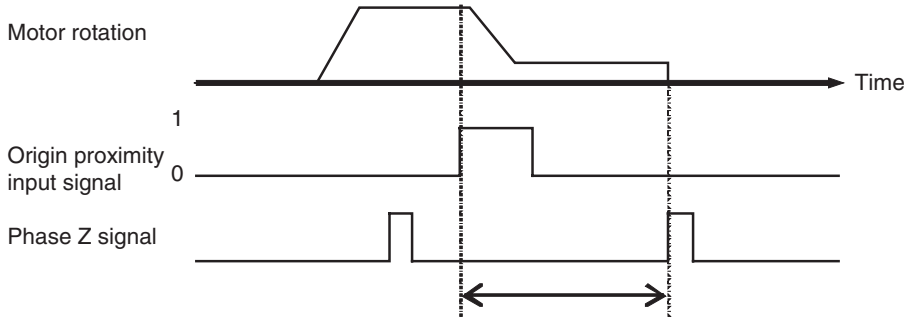
8-5-3 Phase Z Margin for Specific Operation Patterns

Phase Z Margin Required for Origin Search Settings

Up to a maximum of two MECHATROLINK communications cycles plus 4 ms may be required to start searching for the origin signal after detecting the origin proximity signal for the following origin search operation patterns.

- When the origin detection method is set to any setting other than 0 (Origin proximity input signal reversal)
- When an absolute encoder zero point position offset is set for the origin search

When performing an origin search with one of the above operation patterns, the following margin must be provided in the phase Z signal after the origin proximity input signal turns ON.

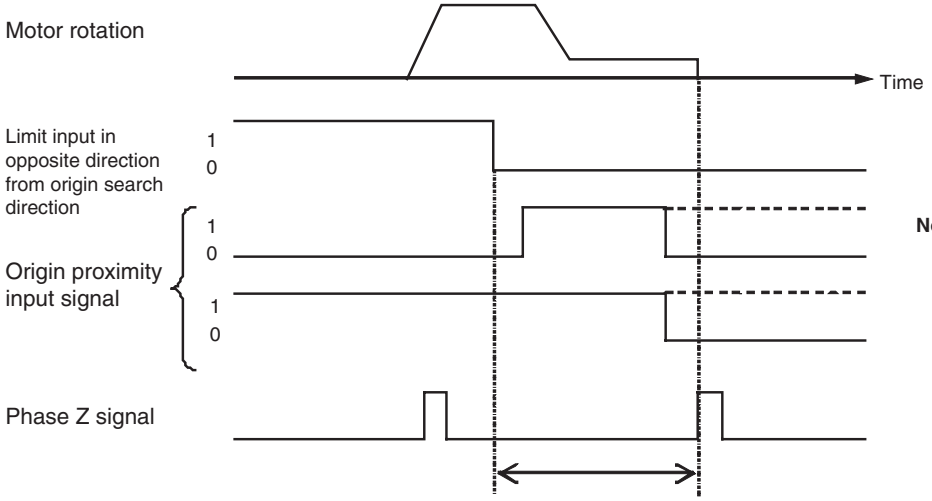


Provide a margin in the phase Z signal of at least two MECHATROLINK communications cycles plus 4 ms.

Phase Z Margin Required for External Input Signals

If the limit input signal in opposite direction from origin search direction and the origin proximity signal are close or overlapping, up to a maximum of two MECHATROLINK communications cycles plus 4 ms may be required to start searching for the origin signal after detecting the origin proximity signal.

In this case, the following margin must be provided in the phase Z signal after the limit input signal in opposite direction from origin search direction turns OFF.



Note: The origin search operation settings determine the motor operation and phase Z signal detection operation when the origin proximity input signal turns ON or OFF.

Provide a margin in the phase Z signal of at least two MECHATROLINK communications cycles plus 4 ms.

8-6 Absolute Encoder Origin

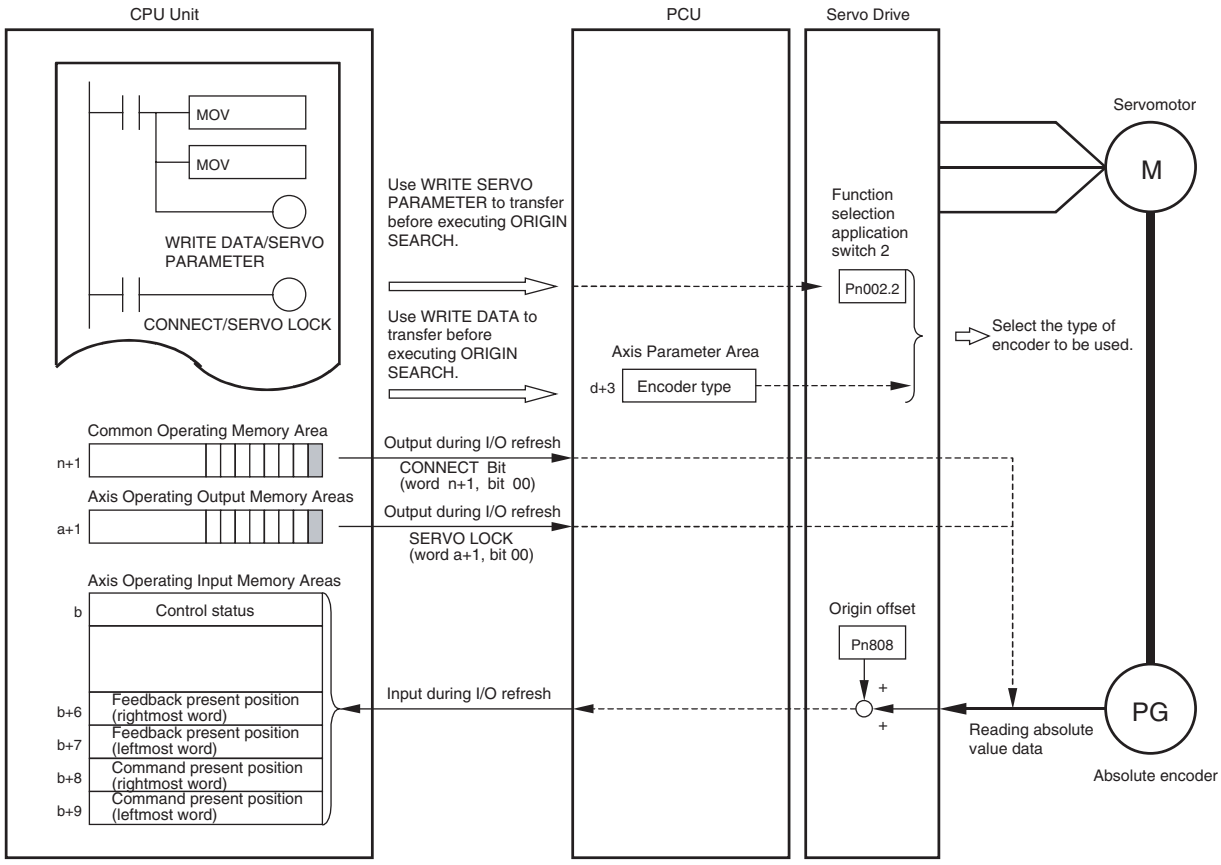
8-6-1 Absolute Encoder Overview

The absolute encoder's battery backup enables absolute value data to be held even if the power to the CPU Unit (PCU) or Servo Drive is turned OFF. Therefore, after turning ON the power to the CPU Unit (PCU), the saved absolute value data can be read, enabling positioning at the present position that existed before the power was turned OFF.

The Servo Parameter *Absolute Origin Offset* for G-series Servo Drives (Pn200) or *Absolute Encoder Zero Point Position Offset* for W-series Servo Drives (Pn808) for absolute value data that is read can be used to offset the mechanical origin.

When an absolute encoder is used to determine the origin, it is not necessary to perform origin searches every time the power is turned ON, as is required for devices such as incremental encoders.

The following is an example for using a W-series Servo Drive.



n: Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Applicable Servomotors

The following Servomotors with absolute encoders support this function.

OMRON G-series Servomotors
Model: R88M-G□S/G□T

OMRON W-series Servomotors
Model: R88M-W□S/W□T

The SMARTSTEP Junior Servo Drives cannot be used with motors with absolute encoders.

8-6-2 Absolute Encoder Operating Procedure

The procedure for using an absolute encoder is as given below. The following procedure is performed just once when using the absolute encoder for the first time, when replacing the Servomotor, when the absolute encoder's battery expires, or when another reason occurs that results in loss of absolute value data.

1,2,3...

1. Set the Common Parameters and save them.
2. Set the Axis Parameters and save them.
3. Turn the PCU OFF and then ON again or restart the Unit.
   The data for the Common Parameters and Axis Parameters set in steps 1 and 2 above are enabled.
4. Start MECHATROLINK communications.

5. Set the absolute encoder type to be used in *Operation Switch When Using Absolute Encoder* (Pn002.2 for W Series and Pn00B for G Series).
   This step is not required if using the default setting.
6. Setup the absolute encoder.
   After setting up the absolute encoder, the power to the Servo Drive must be turned OFF and then ON again.
7. Start MECHATROLINK communications.
   When the connection is established, the absolute value data is read from the absolute encoder.
8. Set the mechanical origin.
9. Set the origin position offset for the absolute encoder.

After completing this procedure, the mechanical origin will be set whenever the power is turned ON or MECHATROLINK communications are started.

Establishing the Origin with an Absolute Encoder

The following differences exist in origin searches when using a motor with an absolute encoder depending on the unit version of the Position Control Unit.

Position Control Units with Unit Version 1.3 or Earlier

Position Control Units with unit version 1.3 or earlier do not support origin search operations for absolute encoders.

When the origin search operation is executed, the present position is cleared to 0 or, if the origin search preset function is enabled, it is set to the present command value after the origin has been established. Any absolute value data previously read by the Position Control Unit is lost. If the absolute value data is later read from the absolute encoder, e.g., when the Servo is unlocked and locked, the coordinate system based on the absolute value data previously saved in the absolute encoder will be used instead of the origin established by the origin search operation.

Position Control Units with Unit Version 2.0 or Later

When the origin search operation is executed, the present position is cleared to 0 or, if the origin search preset function is enabled, it is set to the present command value after the origin has been established. If the origin search operation pattern is set to reversal mode 1, the zero point position offset of the absolute encoder will be set automatically and saved in the Servo Parameters. The mechanical origin and the zero point position offset in the absolute encoder can thus be set simultaneously by using a Position Control Units with unit version 2.0 or later and reversal mode 1 with an absolute encoder.

Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details on setting the zero point position offset using an origin search.

Note ORIGIN SEARCH can also be executed when using Servomotors with absolute encoders. By executing ORIGIN SEARCH, however, the present position will be cleared to 0 when the origin is established. Therefore, the absolute data read to the PCU in Servo lock status will be lost unless the zero point position offset is set using the origin search operation for a Position Control Units with unit version 2.0 or later. The absolute data saved in the absolute encoder will not be lost and can be obtained by executing SERVO UNLOCK after the origin search has been completed, and then executing SERVO LOCK again. The origin position detected, however, will be displaced due to SERVO UNLOCK execution. Therefore, do not execute ORIGIN SEARCH when using a Servomotor with absolute encoder unless you set the zero point position offset using the origin search operation for a Position Control Units with unit version 2.0 or later.

8-6-3 PCU Data Settings for Using Absolute Encoders

The parameters and data required when using absolute encoders are as follows:

Axis Parameter Area

The following parameters are for the operation mode for origin searches.

PCU's address	Contents				Setting
	15 to 12	11 to 08	07 to 04	03 to 00	
d+2	0 (fixed)	0 (fixed)	0 (fixed)	Encoder type	0: Incremental encoder (default setting) 1: Absolute encoder

d = 1860 hex + (Axis No. −1) × 14 hex

When using an absolute encoder, make sure that the settings for the encoder type in the Axis Parameters and *Operation Switch When Using Absolute Encoder* in the Servo Parameters match.

Axis Parameter Area Encoder type	G-series Servo Parameter Pn00B (Operation switch when using absolute encoder)	
	0: Use as an absolute encoder. 2: Use as an absolute encoder but ignore absolute multi-turn counter overflow alarm.	1: Use as an incremental encoder.
0: Incremental encoder	Do not set this combination.	This setting is used when using an absolute encoder as an incremental encoder
1: Absolute encoder	This setting is used when using an absolute encoder as an absolute encoder. (Set this combination when using an absolute encoder.)	Do not set this combination.

Axis Parameter Area Encoder type	W-series Servo Parameter Pn002.2 (Operation switch when using absolute encoder)	
	0: Use as absolute encoder.	1: Use as incremental encoder.
0: Incremental encoder	Do not set this combination.	This setting is used when using an absolute encoder as an incremental encoder
1: Absolute encoder	This setting is used when using an absolute encoder as an absolute encoder. (Set this combination when using an absolute encoder.)	Do not set this combination.

If the settings do not match, reading absolute data will not be possible, or another malfunction may occur.

Servo Parameter Area **Parameters for Using G-series Absolute Encoders**

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn00B	Operation switch when using absolute encoder	---	0 to 2	2	0

Parameters for Using W-series Absolute Encoders

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn002.2	Function selection application switch 2 (operation switch when using absolute encoder)	---	0, 1	2	0

When using a Servomotor with an absolute encoder, select whether the absolute encoder will be used as an absolute encoder or as an incremental encoder. Set this parameter to 0 if using the absolute encoder as an absolute encoder.

When using W-series Servo Drives, the parameter size is the value to be specified when transferring the Servo Parameter including Pn002.

G-series Origin Position Offset Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn200	Absolute origin offset	Command unit	–1,073,741,823 to 1,073,741,823	4	0

W-series Origin Position Offset Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn808	Absolute encoder zero point position offset	Command unit	–1,073,741,823 to 1,073,741,823	4	0

This parameter sets the offset for the mechanical origin from the absolute encoder's absolute value data. The present position will be the absolute value data that was read added to the value in this parameter, and that position is set as the origin.

Note When using the zero point position offset setting function with Position Control Units with unit version 2.0 or later, Pn808 is automatically overwritten when an origin search is performed with an absolute encoder. (Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting*) To achieve this, the Position Control Unit reads and writes Servo Parameter for Pn808 when the origin search operation is started and when it is completed.

Axis Operating Input Memory Areas (Monitor)

Name	Word	Bits	Contents
No Origin Flag	b	06	0: Origin established. 1: No origin established.
Origin Stop Flag		07	0: Outside origin range. 1: Within origin range.
Error Flag		12	0: No axis error. 1: Axis error.
Busy Flag		13	1: Axis busy (axis operation executing).
Feedback present position	b+6 b+7	---	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
Command present position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

8-6-4 Absolute Encoder Setup

The absolute encoder setup must be performed when using the absolute encoder for the first time, initializing the rotation amount to 0, or having left the absolute encoder for a long time without connecting a battery.

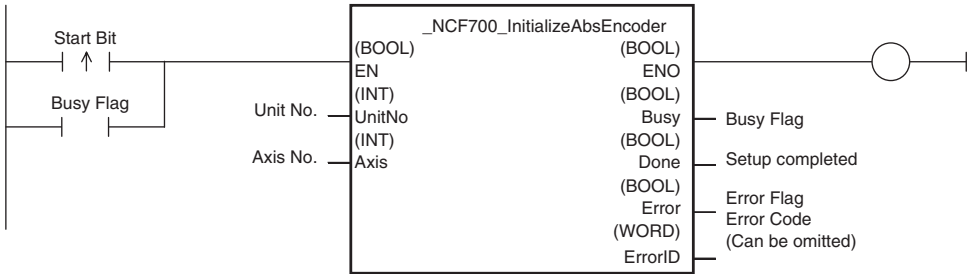
The following methods can be used to set up the absolute encoder when using a Position Control Unit with unit version 1.2 or later.

- The absolute encoder can be set up using the CX-Motion-NCF.
- The absolute encoder can be set up from the user program using a function block from the OMRON FB Library.
- The absolute encoder can be set up using the Servo Drive's Setting Tool.

Refer to the *SYSMAC CX-Motion-NCF Programmable Controller Operation Manual* (Cat. No. W436) for information on setting up the absolute encoder from the CX-Motion-NCF.

When setting up an absolute encoder using the function block from the OMRON FB Library, use a CPU Unit with unit version 3.0 or later.

Absolute Encoder Setup Function Block in OMRON FB Library: _NCF700_InitializeAbsEncoder



The absolute encoder setup can be executed by specifying the unit number and axis number for the function block, and setting the Start Bit.

For information on function block operating requirements and precautions, refer to the *OMRON FB Library Reference Manual* (Cat. No. W442).

When using a PCU with unit version 1.1 or earlier, absolute encoder setup is executed using the Servo Drive's Setting Tool. For details on absolute encoder setup operations using the Servo Drive Setting Tool, refer to the operation manual for the connected Servo Drive.

Note After executing absolute encoder setup, be sure to turn ON the Servo Drive's control power supply again. Not doing so will prevent the Servo Drive's response to PCU commands, and normal operation will not be possible.

8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting

When Absolute Origin Offset for G Series (Pn200) or Absolute Encoder Zero Point Position Offset for W Series (Pn808) = 0 (Default)

1,2,3... 1. Start MECHATROLINK communications (establish a connection using CONNECT).

2. Use jogging or other operation to place the machine in the mechanical origin position. ORIGIN SEARCH cannot be used when using an absolute encoder.

3. Confirm the feedback present position in the Servo unlocked state and set the origin position offset based on this present position. When the Servo is locked, the present position may oscillate, or deviation will accumulate in the Servo Drive, which may prevent the correct set value from being obtained for the origin position offset, causing displacement of the origin.
4. Reverse the sign of the value for the feedback present position read in step 3 and write this value in *Absolute Encoder Zero Point Position Offset* (Pn808). Use SAVE SERVO PARAMETER to write the value to the Servo Drive's non-volatile memory.
5. Execute DEVICE SETUP or turn the power to the Servo Drive OFF and then ON again.

The absolute encoder origin position offset that has been set is now enabled.

When Absolute Origin Offset for G Series (Pn200) or Absolute Encoder Zero Point Position Offset for W Series (Pn808) = Not 0

When the *Absolute Origin Offset* for G Series (Pn200) or *Absolute Encoder Zero Point Position Offset* for W Series (Pn808) is set to a value other than 0, such as when replacing the Servomotor, use either of the following methods to set the origin position offset.

Method 1: First set the origin position offset to 0 (set *Absolute Origin Offset* for G Series (Pn200) or *Absolute Encoder Zero Point Position Offset* for W Series (Pn808) to 0) using SAVE SERVO PARAMETER), and then set it according to the setting method for when Pn808 is 0.

Method 2: Use the above setting method for when the absolute encoder zero point position offset is 0, and calculate the set value in step 4 using the following equation.
New zero point position offset value = Present zero point position offset value − Feedback present position

Note There is a limit to the number of times non-volatile memory in the Servo Drive can be written (10,000 times). Do not save *Absolute Origin Offset* (Pn200) for G Series or *Absolute Encoder Zero Point Position Offset* (Pn808) for W Series too frequently.

Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation

The *Absolute Origin Offset* for G Series (Pn200) and *Absolute Encoder Zero Point Position Offset* for W Series (Pn808) can be automatically set at the end of an origin search by executing the origin search with the following operation pattern with a Position Control Unit with unit version 2.0 or later.

Operation pattern: Reversal mode 1

Origin detection method: Origin proximity input signal reversal, No origin proximity input signal reversal, or Do not use origin proximity input signal

To enable setting the absolute encoder zero point position offset with an origin search operation, the following axis parameter settings must be used with the above origin search operation pattern.

Origin search preset: Set.

Encoder type: Absolute Encoder

Axis Parameters

The following parameters are used to set the origin search operation mode.

PCU's address	Contents						Setting
	15 to 14	13	12	11 to 08	07 to 04	03 to 00	
d+1	0 (fixed)	Origin search preset	Origin search direction	Origin detection method	Origin search operation	0 (fixed)	Set the origin search operation. Origin search direction 0: Reversal mode 1 Origin detection method 0: With origin proximity input signal reversal (default setting) 1: Without origin proximity input signal reversal 2: Not use origin proximity input signal Origin search direction 0: Forward (default setting) 1: Reverse Origin search preset 1: Set
d+2	0 (fixed)	0	0	0 (fixed)	0 (fixed)	Encoder type	1: Absolute encoder

d = 1860 hex + (Axis No. −1) × 14 hex

When setting the absolute encoder's zero point position offset using an origin search, set the position command value (i.e., the present position preset value) to 0 and enable the origin search preset even when the preset value is not being used for the origin search.

Note

- Each time the absolute encoder zero point position offset is set using an origin search operation, the *Absolute Origin Offset* for G Series (Pn200) or *Absolute Encoder Zero Point Position Offset* for W Series (Pn808) is saved to non-volatile memory in the Servo Drive. There is a limit to the number of times non-volatile memory in the Servo Drive can be written (10,000 times). Do not save the *Absolute Origin Offset* for G Series (Pn200) or *Absolute Encoder Zero Point Position Offset* for W Series (Pn808) too frequently.
- The absolute encoder zero point position offset will not be set correctly using an origin search operation if an error occurs before the end of the origin search operation. Repeat the operation if an error occurs.
- If the absolute encoder PG zero point position offset is set using an origin search operation, the MECHATROLINK transfer cycle and communications cycle settings will need to be changed. Refer to *Transfer Cycle and Communications Cycle When Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation with Position Control Units with Unit Ver. 2.0* on page 230 and set the transfer cycle and communications cycle correctly. If the transfer cycle and communications cycle are not set correctly, the function to set the absolute encoder PG zero point position offset using an origin search operation will not operate correctly.

8-6-6 Establishing the Origin Using an Absolute Encoder

The Position Control Unit establishes the origin by reading the absolute value data saved in the absolute encoder using the following timing.

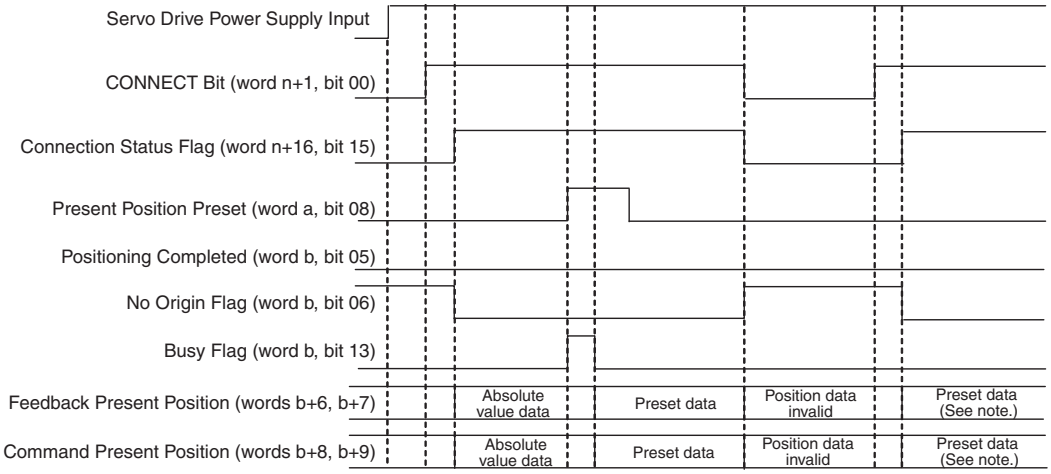
The zero point position offset that is set as a Servo parameter is added to the absolute value data that is read and input to the Axis Operating Input Memory Areas as the present position of the Position Control Unit.

In the following sections, the present position is given as the sum of the travel distances for the operations for each axis.

G-series Servo Drives

Turning ON the Servo Drive

When the control power supply is turned ON, the G-series Servo Drive reads the absolute value data of the Servomotor with the absolute encoder to the Servo Drive. When MECHATROLINK communications start (i.e., when a connection is established), the Position Control Unit updates the present position using the absolute value data read from the Servo Drive.


Servo Drive Power Supply Input
CONNECT Bit (word n+1, bit 00)
Connection Status Flag (word n+16, bit 15)
Present Position Preset (word a, bit 08)
Positioning Completed (word b, bit 05)
No Origin Flag (word b, bit 06)
Busy Flag (word b, bit 13)
Feedback Present Position (words b+6, b+7)
Absolute value data
Preset data
Position data invalid
Preset data (See note.)
Command Present Position (words b+8, b+9)
Absolute value data
Preset data
Position data invalid
Preset data (See note.)

The present position data will be read from the Servo Drive and the origin will be established when CONNECTION Bit is set and the MECHATROLINK is in communications status (the Connection Status Flag is ON).

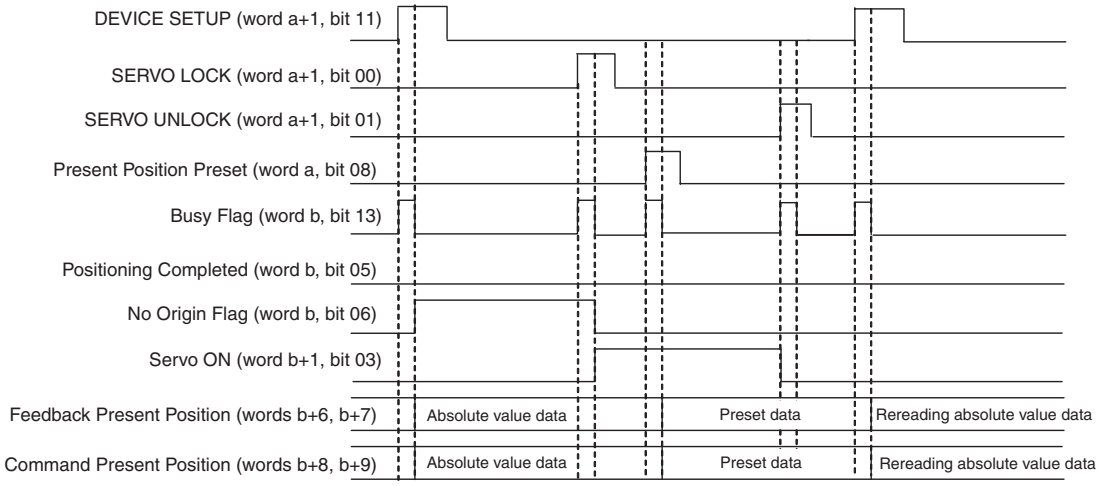
The origin will not be established (the No Origin Flag will be ON) and the present position will become invalid data when CONNECTION Bit is set and MECHATROLINK communications are stopped (the Connection Status Flag is OFF).

Note: Once the Present Position Preset has been executed, the preset data will be read when the connection is established until the absolute value data is read again.

n = Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. −1) × 25

Executing DEVICE SETUP

The absolute value data for the axis for which DEVICE SETUP was executed is read.


DEVICE SETUP (word a+1, bit 11)
SERVO LOCK (word a+1, bit 00)
SERVO UNLOCK (word a+1, bit 01)
Present Position Preset (word a, bit 08)
Busy Flag (word b, bit 13)
Positioning Completed (word b, bit 05)
No Origin Flag (word b, bit 06)
Servo ON (word b+1, bit 03)
Feedback Present Position (words b+6, b+7)
Command Present Position (words b+8, b+9)
Absolute value data
Preset data
Rereading absolute value data
Absolute value data
Preset data
Rereading absolute value data

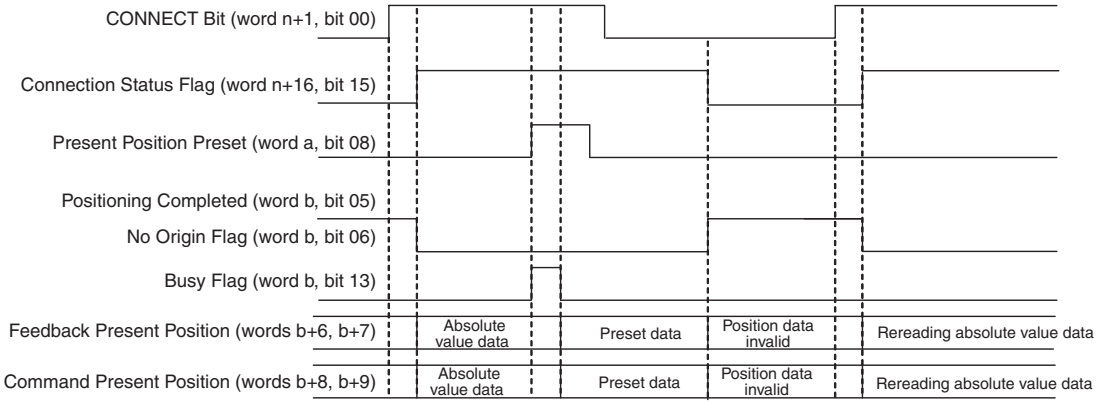
Once the connection has been established, the zero point position offset will be set, and the origin will not be established (the No Origin Flag will be OFF) if the offset is enabled using the device setup with MECHATROLINK in communications status. Then, the origin will be updated using the set present position offset when SERVO LOCK is executed.

n = Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)
a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. −1) × 25

W-series Servo Drives

Starting MECHATROLINK Communications (When a Connection Has Been Established)

Absolute value data is read for all axes of the Servomotors with absolute encoders that are registered in the scan list.


CONNECT Bit (word n+1, bit 00)
Connection Status Flag (word n+16, bit 15)
Present Position Preset (word a, bit 08)
Positioning Completed (word b, bit 05)
No Origin Flag (word b, bit 06)
Busy Flag (word b, bit 13)
Feedback Present Position (words b+6, b+7)
Command Present Position (words b+8, b+9)
Absolute value data
Preset data
Position data invalid
Rereading absolute value data
Absolute value data
Preset data
Position data invalid
Rereading absolute value data

The absolute value data will be read and the origin will be established when the CONNECTION Bit is set and MECHATROLINK is in communications status (the Connection Status Flag is ON).

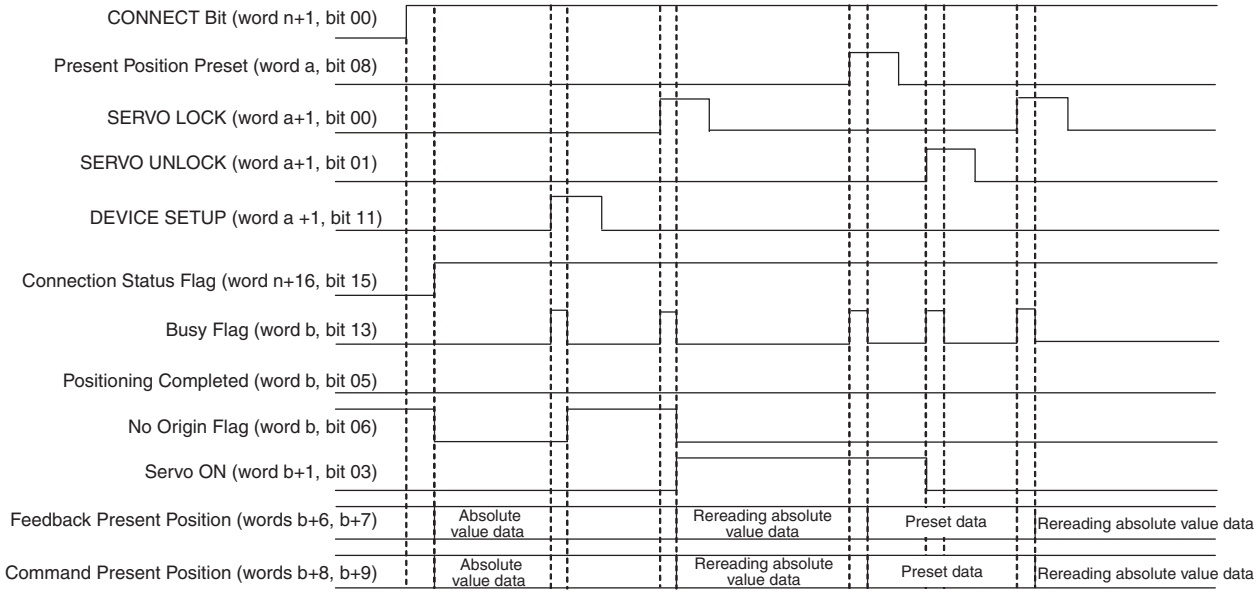
The origin will not be established (the No Origin Flag will be ON) and the present position will become invalid data when the CONNECT Bit is OFF and the MECHATROLINK communications are stopped (the Connection Status Flag is OFF).

n = Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. −1) × 25

Executing SERVO LOCK

Absolute value data for the axis for which SERVO LOCK was executed is read.

If the absolute encoder zero point offset or other offline parameter is set and DEVICE SETUP is executed to enable the absolute encoder zero point offset while continuing MECHATROLINK communications, the origin for that axis will not be established. In that case, the absolute value data will be read again and the origin will be established based on the new parameter setting by executing SERVO LOCK.


CONNECT Bit (word n+1, bit 00)
Present Position Preset (word a, bit 08)
SERVO LOCK (word a+1, bit 00)
SERVO UNLOCK (word a+1, bit 01)
DEVICE SETUP (word a +1, bit 11)
Connection Status Flag (word n+16, bit 15)
Busy Flag (word b, bit 13)
Positioning Completed (word b, bit 05)
No Origin Flag (word b, bit 06)
Servo ON (word b+1, bit 03)
Feedback Present Position (words b+6, b+7)
Command Present Position (words b+8, b+9)
Absolute value data
Rereading absolute value data
Preset data
Rereading absolute value data
Absolute value data
Rereading absolute value data
Preset data
Rereading absolute value data

Once the connection has been established, the zero point position offset will be set, and the origin will not be established (the No Origin Flag will be OFF) if the offset is enabled using the device setup while continuing MECHATROLINK communications. Then, the absolute value data will be read again and the origin updated with the set present position offset will be established by executing SERVO LOCK.

n = Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)
a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. –1) × 25
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. –1) × 25

Note

(1) Parameters that are not saved in the non-volatile memory built into the Servo Drive will be lost when DEVICE SETUP is executed. If data must be saved to the non-volatile memory, execute SAVE SERVO PARAMETER first.

(2) The set data will be overwritten with the present position data of the Servo Drive when PRESENT POSITION PRESET is executed. To read the absolute value data again, turn OFF and ON again the power supply of the Servo Drive or execute DEVICE SETUP for a G-series Servo Drive, and start MECHATROLINK communications or execute SERVO LOCK for a W-series Servo Drive.

SECTION 9
Positioning

This section provides an overview of direct operation and describes the parameter settings, data settings, and procedures required to perform direct operation. Information on interrupt feeding and torque limits is also provided here.

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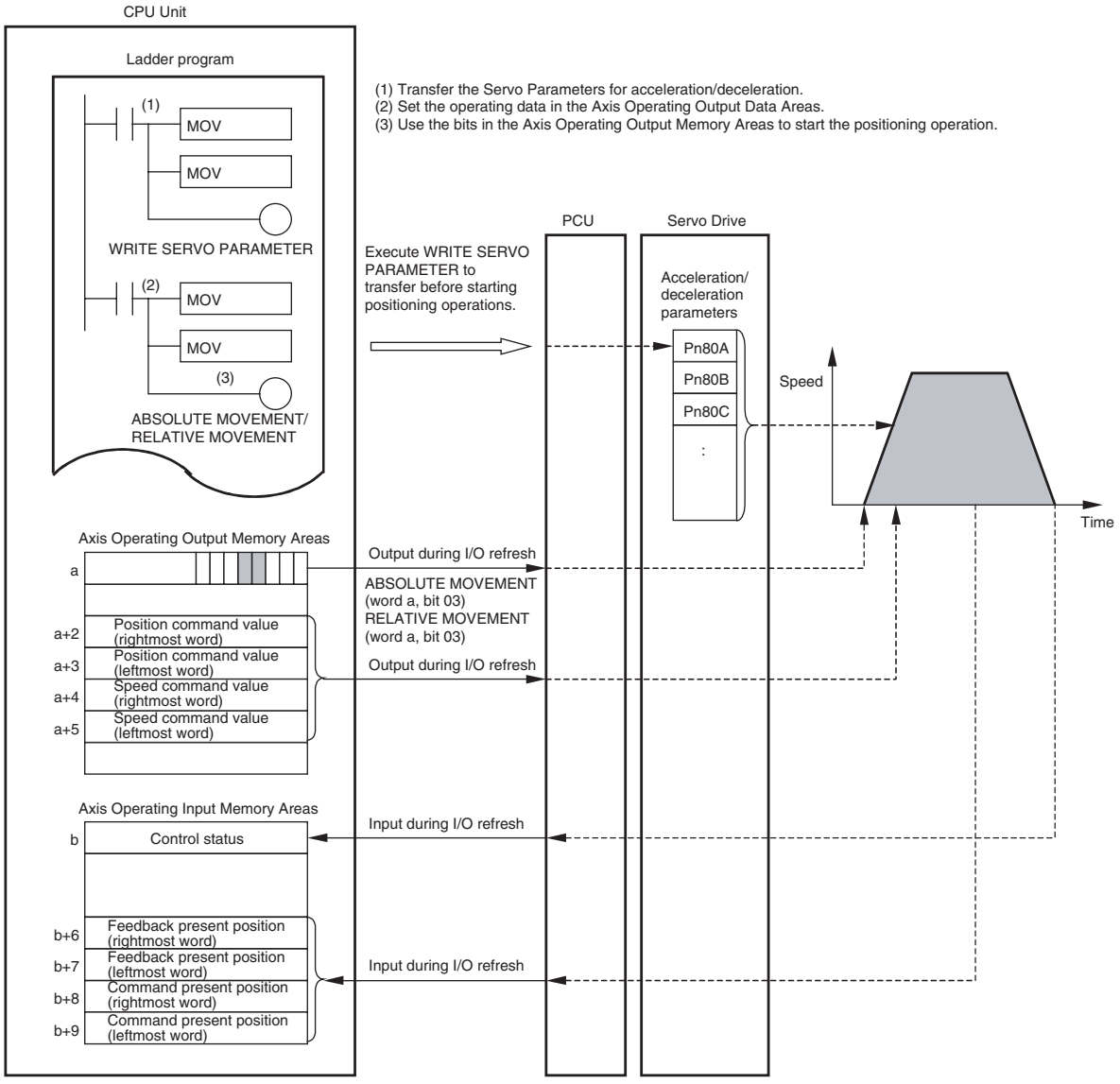
9-1 Direct Operation Overview

Direct operation of the PCU enables positioning by simply writing target position data and target speed data directly from a ladder program to a specified area in the CPU Unit.

Positioning operations using direct operation are executed according to the position command value and speed command value in the Axis Operating Memory Area set in Common Parameters and the acceleration/deceleration constants set in the Servo Parameters.

The following is an example for a W-series Servo Drive.



a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The position command value and speed command value set in the Axis Operating Output Memory Area using the MOV instruction are output to the PCU automatically during I/O refresh. Direct operation is started when the ABSOLUTE MOVEMENT Bit or RELATIVE MOVEMENT Bit allocated in the Axis Operating Output Memory Area turns ON.

9-2 Direct Operation Procedure

The procedure for using direct operation is as follows:

1,2,3...

1. Set the Common Parameters and save them.
2. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters set in step 1 above is enabled.
3. Start MECHATROLINK communications.
4. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute direct operation.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
   To enable changed offline parameters, turn ON the power to the Servo Drive again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
5. Execute SERVO LOCK.
6. Set the data used for direct operation.
   Set the positioning data for direct operation in the position command value of the Axis Operating Output Memory Area.
   Set the speed data for direct operation in the speed command value of the Axis Operating Output Memory Area.
7. Start ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

When using the PCU for the first time or to change the Common Parameter data, steps 1 and 2 must be performed.

After executing SERVO LOCK, WRITE SERVO PARAMETER can be executed to set the acceleration/deceleration used each time positioning is performed.

Note When specifying the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change parameters during axis operation.
Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

9-3 PCU Data Settings for Direct Operation

A simple explanation of the main parameters and data used to execute direct operation is provided here. To execute direct operation, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.

G-series Servo Parameters

Servo Parameter Area

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
Acceleration/deceleration filters	Pn10E	Moving average time	0.1 ms	0 to 5100	2	0

W-series and SMARTSTEP Junior Servo Parameters

Servo Parameter Area

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMARTSTEP Junior
Acceleration/deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
Acceleration/deceleration filters	Pn810	Exponential acceleration/deceleration bias	Command units/s	0 to 32767	2	0	Supported	Not supported
	Pn811	Exponential acceleration/deceleration time constant	0.1 ms	0 to 5100	2	0	Supported	Not supported
	Pn812	Movement average time	0.1 ms	0 to 5100	2	0	Supported	Not supported

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

Control Status Parameters

Model	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
R88D-GN□-ML2	Pn060	Positioning completion range 1	Command unit	0 to 10000	2	25
R88D-WT□	Pn500	Positioning completion range 1	Command unit	0 to 250	2	3
R88D-WN□-ML2	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	3
SMART-STEP Junior	Pn522	Positioning completion range 1	Command unit	0 to 1073741824	4	10

Minimum Limit Settings

Under the following conditions, the Servo Parameters listed above, apart from Pn80B, Pn80E, and Pn500/Pn522, are used with the default settings and do not need to be changed.

- Command unit: Pulse
- Acceleration/deceleration curve: Linear acceleration/deceleration for a single step only (trapezoidal curve)

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
ABSOLUTE MOVEMENT	a	03	0 → 1: Starts absolute movement.	Supported	Supported	Supported
RELATIVE MOVEMENT		04	0 → 1: Starts relative movement.	Supported	Supported	Supported
INTERRUPT FEEDING		05	1: Enables interrupt feeding.	Supported	Supported	Supported
Position command value	a+2 a+3	---	Position command value (rightmost word) Position command value (leftmost word) Unit: Command unit Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex) The command value is limited by the allowable positioning range when using RELATIVE MOVEMENT. (For details, refer to *9-4-1 Starting Direct Operation*.)	Supported	Supported	Supported
Speed command value	a+4 a+5	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex) The upper limit setting of the speed command value depends on the Servo Drive specifications.	Supported	Supported	Supported

Name		Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
Acceleration/deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/deceleration curve.	Supported	Supported	Not supported
Forward rotation current limit			14	1: Use forward torque limit.	Supported	Supported	Not supported
Reverse rotation current limit			15	1: Use reverse torque limit.	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The settings of the following are enabled when the movement command start bit turns ON: Position command value, Acceleration/Deceleration Curve Designation Bit, Interrupt Feeding Designation Bit, and Forward/Reverse Rotation Current Limit Designation Bit.

The speed command value can always be changed during operation. By overwriting the speed command value, the speed for the positioning operation can be changed.

The G-series Servo Drives do not support exponential curve designation filters. When using a G-series Servo Drive, do not attempt to use an exponential curve designation.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Drive, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

Note Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
PCU Positioning Completed Flag		05	0 → 1: Positioning is completed.
No Origin Flag		06	0: Origin established. 1: No origin established.
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing)
Feedback present position	b+6 b+7	---	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
Command present position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start direct operation is received by the PCU. Use the Receiving Command Flag when starting and changing target positions to control the ON/OFF timing for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT.

9-4 Using Direct Operation

9-4-1 Starting Direct Operation

Two methods for starting direct operation are available, as follows:

1,2,3...

1. When the ABSOLUTE MOVEMENT Bit turns ON
2. When the RELATIVE MOVEMENT Bit turns ON

When starting direct operation, make sure that the ABSOLUTE MOVEMENT/RELATIVE MOVEMENT Bit remains ON until the Receiving Command Flag or the Busy Flag in the Axis Operating Input Memory Area turns ON.

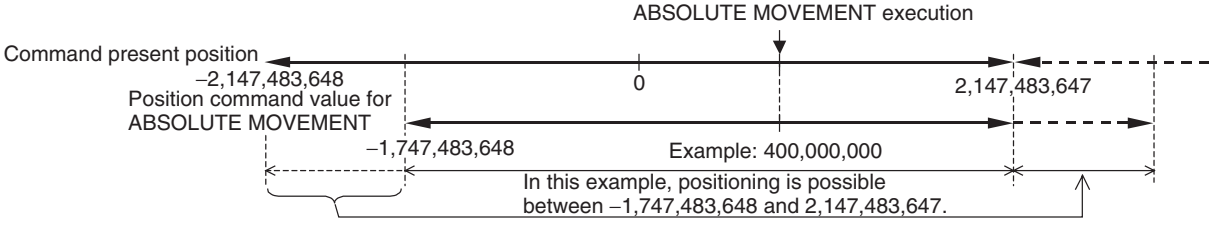
Direct operation commands will be ignored if the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, or DECELERATION STOP Bit is ON. Be sure these bits remain OFF while performing direct operation.

Executing ABSOLUTE MOVEMENT

ABSOLUTE MOVEMENT positions the axis at the specified position using the position command value in the Axis Operating Output Memory Area as absolute data. If ABSOLUTE MOVEMENT is started without the origin established (No Origin Flag = 1), a Present Position Unknown Error (axis error code: 3030) will occur, and positioning will not be executed.

The positioning range for ABSOLUTE MOVEMENT is any absolute position for which the travel amount from the present position is between −2,147,483,648 and 2,147,483,647 (command units).

If ABSOLUTE MOVEMENT is executed for an absolute position that exceeds this range, positioning will be performed not to a position based on the present origin, but to a position exceeding the upper or lower limit of the command present position.



If ABSOLUTE MOVEMENT is executed with a position command value of −2,147,483,648 to −1,747,483,649 in the above example, positioning will be performed to the specified position.

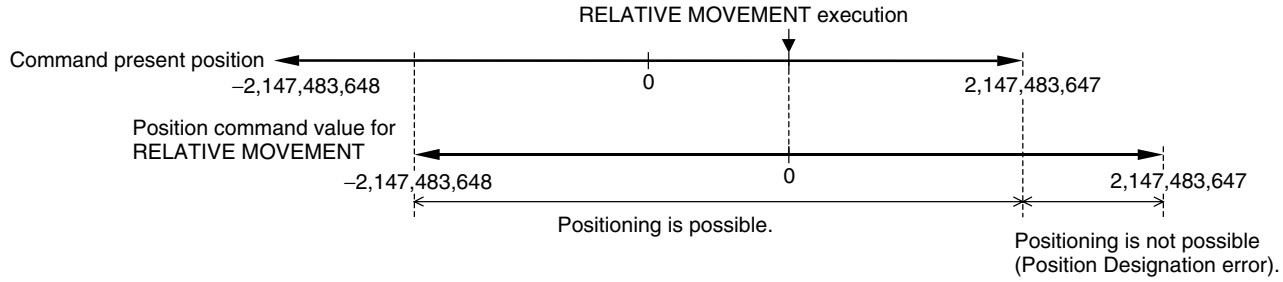
Note If ABSOLUTE MOVEMENT is executed for an absolute position that exceeds the positioning range, the positioning operation will be in the reverse direction to the present origin and the origin will be offset. Do not allow the position command value for ABSOLUTE MOVEMENT to exceed the positioning range. Also, set limit input signals and software limits so that operation will not be performed outside the present positioning range.

Executing RELATIVE MOVEMENT

RELATIVE MOVEMENT positions the axis at the specified position using the position command value in the Axis Operating Output Memory Area as incremental data. RELATIVE MOVEMENT can be executed without the origin established (No Origin Flag = 1), and the position command value will be added to the present position (relative travel distance).

The positioning range for RELATIVE MOVEMENT is a command present position range of –2,147,483,648 to 2,147,483,647 (command units) when it is not limited by limit input signals or software limits. (For details on the command present position, refer to *7-3 Coordinate System and Present Position*.)

The position command value used as the relative travel distance can be specified in the range –2,147,483,648 to 2,147,483,647 (command units), but if the positioning is started with a position command value such that the target position exceeds the positioning range for RELATIVE MOVEMENT, a Position Designation Error (axis error code: 3060) will occur, and the positioning operation will not be executed.

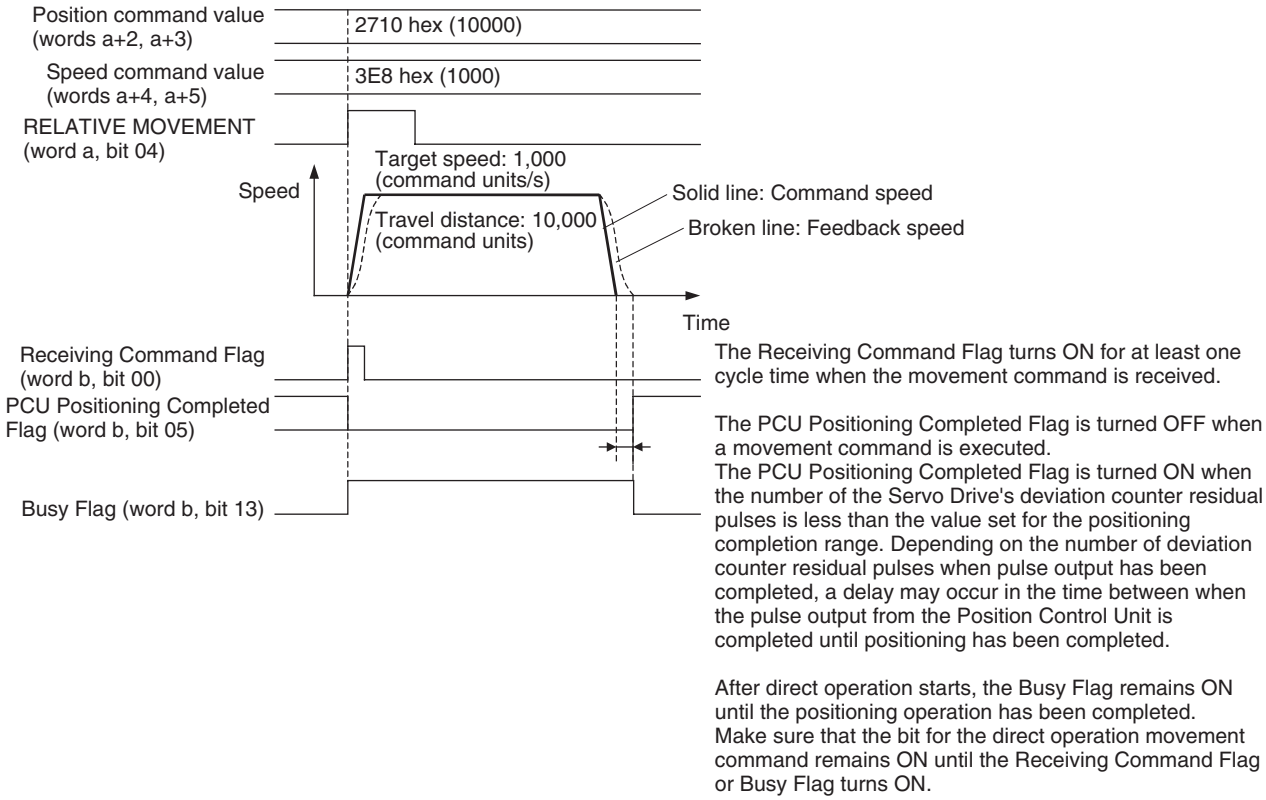


For details on acceleration/deceleration operations during direct operation, refer to *7-4 Acceleration and Deceleration Operations*.

9-4-2 Direct Operation Timing Charts

Timing Chart for Movement Command Execution

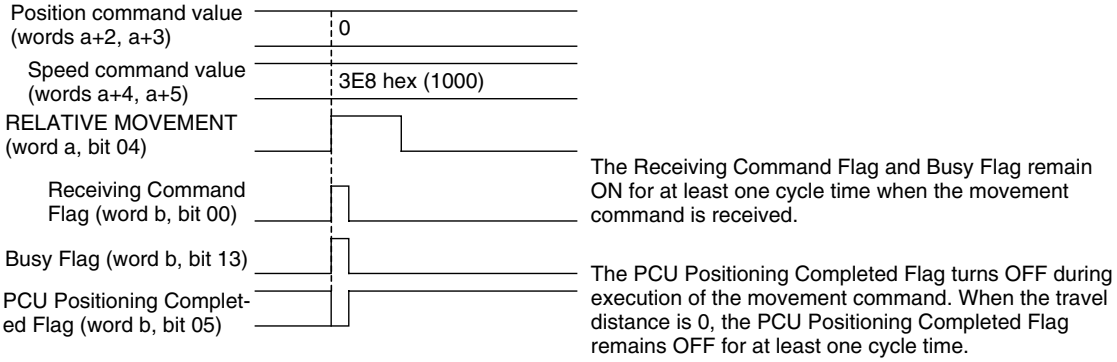
The following timing chart is for when RELATIVE MOVEMENT is executed. The timing chart for ABSOLUTE MOVEMENT is the same, except that positioning is executed with the absolute position.


Position command value
(words a+2, a+3)
2710 hex (10000)
Speed command value
(words a+4, a+5)
3E8 hex (1000)
RELATIVE MOVEMENT
(word a, bit 04)
Target speed: 1,000
(command units/s)
Speed
Travel distance: 10,000
(command units)
Solid line: Command speed
Broken line: Feedback speed
Time
Receiving Command Flag
(word b, bit 00)
PCU Positioning Completed
Flag (word b, bit 05)
Busy Flag (word b, bit 13)
The Receiving Command Flag turns ON for at least one cycle time when the movement command is received.
The PCU Positioning Completed Flag is turned OFF when a movement command is executed.
The PCU Positioning Completed Flag is turned ON when the number of the Servo Drive's deviation counter residual pulses is less than the value set for the positioning completion range. Depending on the number of deviation counter residual pulses when pulse output has been completed, a delay may occur in the time between when the pulse output from the Position Control Unit is completed until positioning has been completed.
After direct operation starts, the Busy Flag remains ON until the positioning operation has been completed.
Make sure that the bit for the direct operation movement command remains ON until the Receiving Command Flag or Busy Flag turns ON.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart for Zero or Minute Travel Distance

The following timing chart applies when ABSOLUTE MOVEMENT is executed to move to the same position as the present position, or RELATIVE MOVEMENT is executed for position data of 0 (i.e., direct operation executed for travel distance of 0), or the positioning operation is ABSOLUTE or RELATIVE MOVEMENT for a minute travel distance that will finish in less than one CPU Unit cycle time.


Position command value
(words a+2, a+3)
0
Speed command value
(words a+4, a+5)
3E8 hex (1000)
RELATIVE MOVEMENT
(word a, bit 04)
Receiving Command
Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Complet-
ed Flag (word b, bit 05)
The Receiving Command Flag and Busy Flag remain ON for at least one cycle time when the movement command is received.
The PCU Positioning Completed Flag turns OFF during execution of the movement command. When the travel distance is 0, the PCU Positioning Completed Flag remains OFF for at least one cycle time.

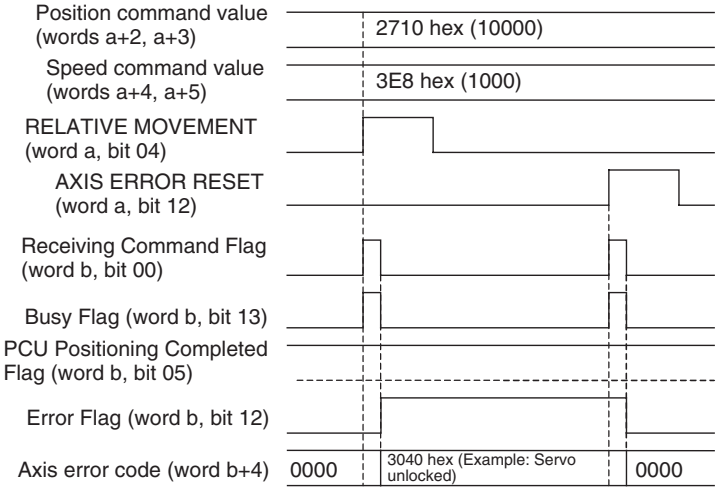
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Even for a zero or minute travel distance, the Receiving Command Flag and Busy Flag for the movement command will remain ON for at least one CPU Unit cycle time.

The PCU Positioning Completed Flag for the movement command will remain OFF for at least one cycle time if positioning stops within the positioning completion range for the target position.

Timing Chart for Error/Warning Flag during Command Execution

If an error occurs due to an illegal command value when a direct operation command is executed, the command will not be executed, and the timing chart will be as follows:


Position command value (words a+2, a+3)
2710 hex (10000)
Speed command value (words a+4, a+5)
3E8 hex (1000)
RELATIVE MOVEMENT (word a, bit 04)
AXIS ERROR RESET (word a, bit 12)
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Completed Flag (word b, bit 05)
Error Flag (word b, bit 12)
Axis error code (word b+4)
0000
3040 hex (Example: Servo unlocked)
0000

The Receiving Command Flag and Busy Flag turn ON for at least one cycle time when the command is received.

The PCU Positioning Completed Flag will not change if direction operation is not performed due to an illegal movement command.

If an illegal movement command is received, the Error Flag will turn ON, and the movement command will not be executed. The Error Flag will turn OFF when the AXIS ERROR RESET Bit is turned ON.

If an error occurs, after the Busy Flag turns ON, the Error Flag will turn ON and the axis error code will be set after either one cycle time or MECHATROLINK communications cycle, whichever is longer.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

If a Servo Drive warning occurs when a movement command is being executed, such as the speed command value exceeding the Servo Drive's limit value, the Error Flag in the above timing chart is replaced by the Warning Flag (word b, bit 11). After the command has been executed and the Busy Flag has been ON for at least one CPU Unit cycle time, the Error Flag and Warning Flag will turn ON at the same time as the Receiving Command Flag and Busy Flag turn OFF after either one PLC cycle time or after one MECHATROLINK communications time, whichever is longer.

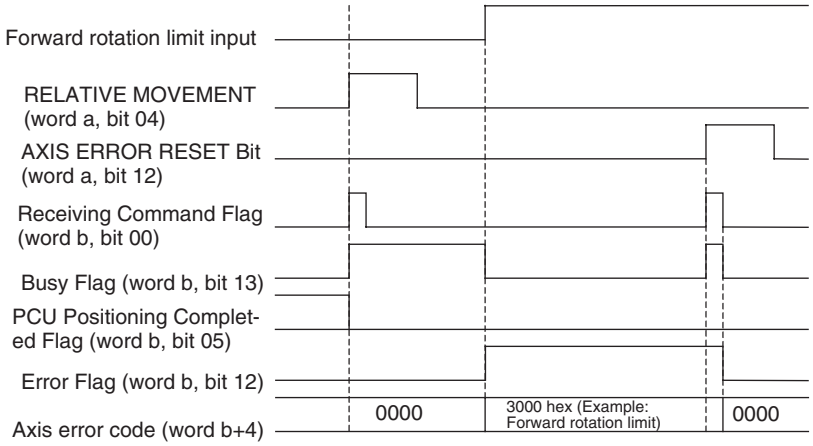
Timing Chart for Errors or Warnings during Axis Operation

When an error occurs during direct operation, such as a limit input during axis operation, the axis will either decelerate to a stop, immediately stop (emergency stop), or continue operation, depending on the error.

The timing charts when an error occurs during axis operation are provided below.

When an Error that Stops (Deceleration/Emergency Stop) Axis Operation Occurred

Example: Limit Input Error

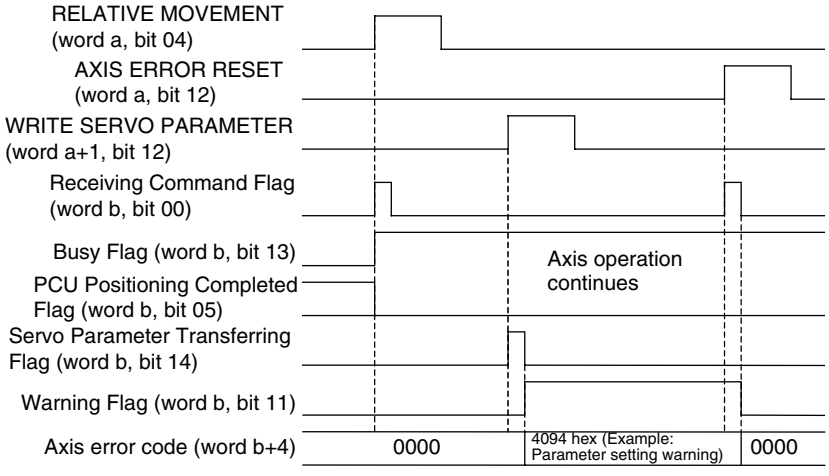

Forward rotation limit input
RELATIVE MOVEMENT (word a, bit 04)
AXIS ERROR RESET Bit (word a, bit 12)
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Completed Flag (word b, bit 05)
Error Flag (word b, bit 12)
Axis error code (word b+4)
0000
3000 hex (Example: Forward rotation limit)
0000

The PCU Positioning Completed Flag turns OFF during execution of the movement command. This flag will not turn ON if the executed positioning command is not completed due to an error.
If an error occurs, the Error Flag will turn ON, the axis error code stored, and the axis will stop according to the stopping method set for when errors occur. The Error Flag will turn OFF when AXIS ERROR RESET is executed. If an error occurs, after the Busy Flag turns ON, the Error Flag and axis error code will remain ON and set for either one cycle time or MECHATROLINK communications cycle, whichever is longer.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

When a Warning Allowing Axis Operation to Continue Occurred

Example: Parameter Setting Warning during Servo Parameter Transfer


RELATIVE MOVEMENT (word a, bit 04)
AXIS ERROR RESET (word a, bit 12)
WRITE SERVO PARAMETER (word a+1, bit 12)
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Completed Flag (word b, bit 05)
Servo Parameter Transferring Flag (word b, bit 14)
Warning Flag (word b, bit 11)
Axis error code (word b+4)
Axis operation continues
0000
4094 hex (Example: Parameter setting warning)
0000

The PCU Positioning Completed Flag turns OFF during execution of the movement command. This flag will not turn ON if the executed positioning command is not completed due to an error.

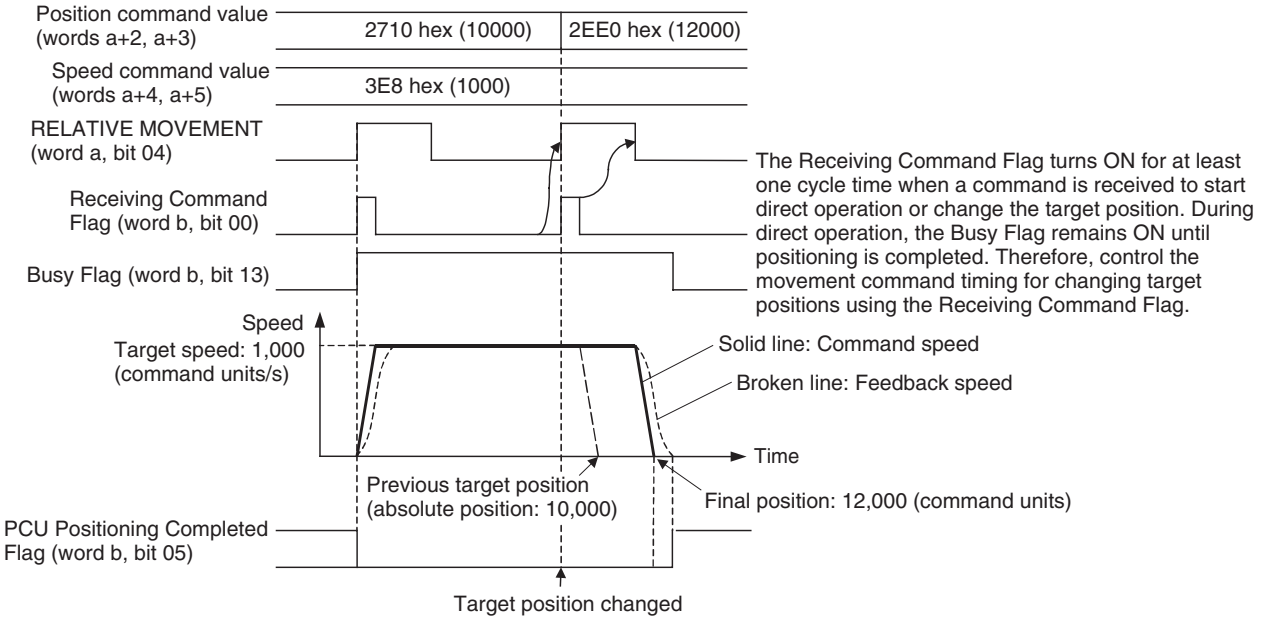
When a warning occurs, the Warning Flag turns ON and the axis error code (warning code) is stored. The Warning Flag will turn OFF when AXIS ERROR RESET is executed.
If an error occurs, after Busy Flag turns ON, the Warning Flag will turn ON and the axis error code will be set after either one cycle time or MECHATROLINK communications cycle, whichever is longest.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

9-4-3 Changing Target Position

during direct operation, the target position for the positioning operation can be changed by setting a new position command value in the Axis Operating Output Memory Area and executing ABSOLUTE MOVEMENT or RELATIVE MOVEMENT again.

The Busy Flag remains ON during direct operation until the positioning operation is completed. The Receiving Command Flag in the Axis Operating Input Memory Area is used to control the ON/OFF timing of the ABSOLUTE/RELATIVE MOVEMENT Bit to change the target position. The target position can be changed when the Receiving Command Flag is OFF. When executing the target position change, make sure that the ABSOLUTE/RELATIVE MOVEMENT Bit remains ON until the Receiving Command Flag turns ON.


Position command value
(words a+2, a+3)
2710 hex (10000)
2EE0 hex (12000)
Speed command value
(words a+4, a+5)
3E8 hex (1000)
RELATIVE MOVEMENT
(word a, bit 04)
Receiving Command
Flag (word b, bit 00)
Busy Flag (word b, bit 13)
The Receiving Command Flag turns ON for at least one cycle time when a command is received to start direct operation or change the target position. During direct operation, the Busy Flag remains ON until positioning is completed. Therefore, control the movement command timing for changing target positions using the Receiving Command Flag.
Speed
Target speed: 1,000
(command units/s)
Solid line: Command speed
Broken line: Feedback speed
Time
Previous target position
(absolute position: 10,000)
Final position: 12,000 (command units)
PCU Positioning Completed
Flag (word b, bit 05)
Target position changed

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

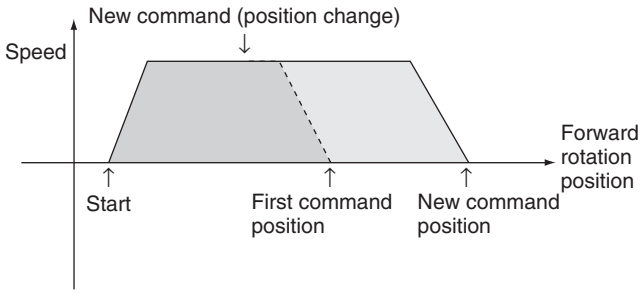
Note

(1) When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time when the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

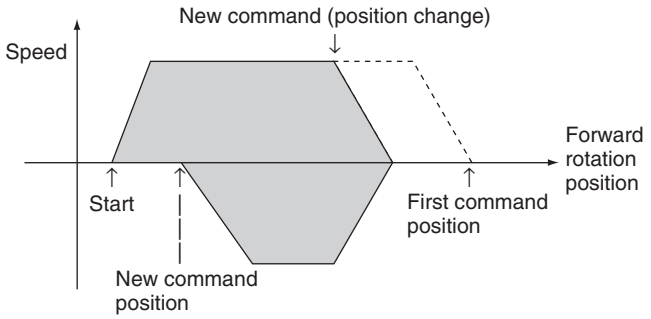
(2) When executing the movement command again during axis operation to change the target position, do not change the acceleration/deceleration curve designation from the original setting when operation was started. Changing the acceleration/deceleration curve designation when changing the target position during axis operation may result in displaced positioning or other malfunction.

Operation Pattern when Changing the Target Position

Without Reversal Operation

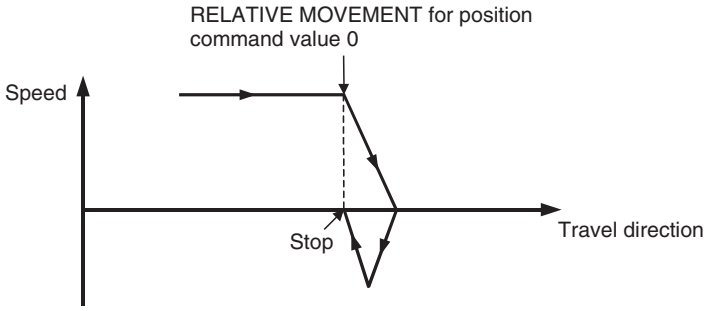


With Reversal Operation



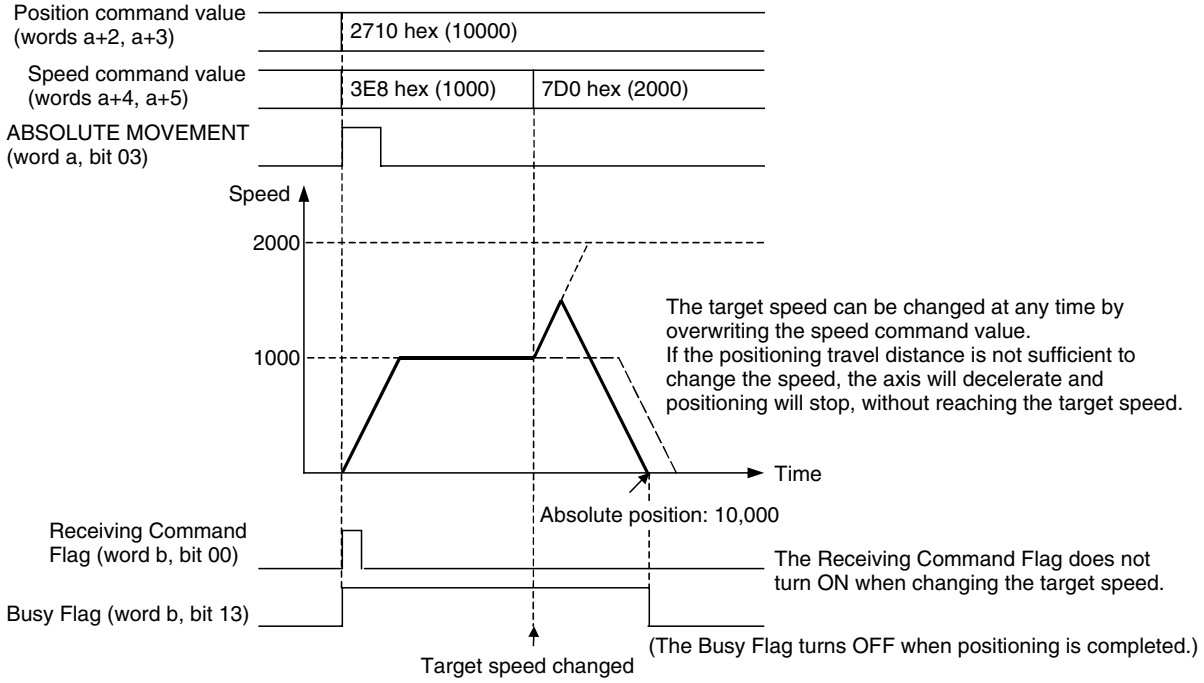
Executing Change to Target Position for Small Travel Distance

If the target position is changed using RELATIVE MOVEMENT executed for a zero or minute travel distance or ABSOLUTE MOVEMENT executed to a position near the present position, positioning will be performed to the target position after decelerating to a stop and reversing direction.

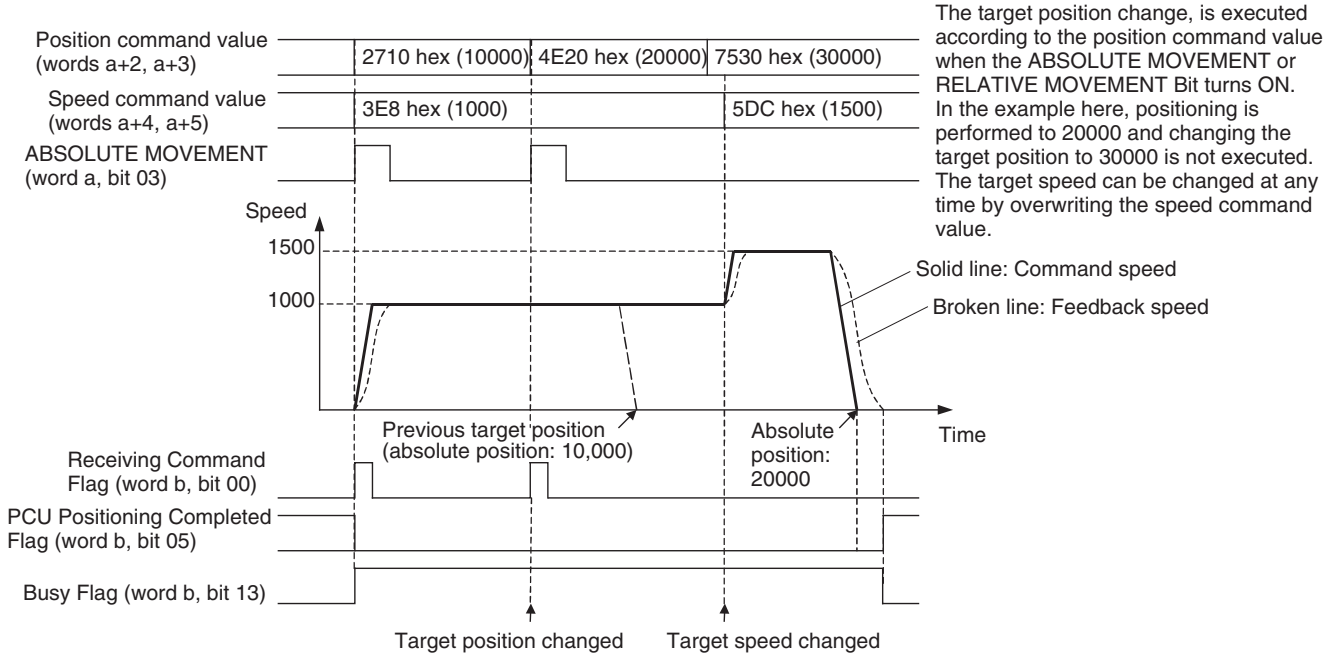


9-4-4 Changing Target Speed

during direct operation, by setting a new speed command value in the Axis Operating Output Memory Area, the target speed for the positioning operation can be changed. The speed command value is enabled at the I/O refresh after it is set in the Axis Operating Memory Area. The PCU starts changing to the new target speed at the acceleration/deceleration set in the Servo Parameters when the new speed command value is enabled.


Position command value
(words a+2, a+3)
2710 hex (10000)
Speed command value
(words a+4, a+5)
3E8 hex (1000)
7D0 hex (2000)
ABSOLUTE MOVEMENT
(word a, bit 03)
Speed
2000
1000
The target speed can be changed at any time by overwriting the speed command value.
If the positioning travel distance is not sufficient to change the speed, the axis will decelerate and positioning will stop, without reaching the target speed.
Time
Absolute position: 10,000
Receiving Command
Flag (word b, bit 00)
The Receiving Command Flag does not turn ON when changing the target speed.
Busy Flag (word b, bit 13)
(The Busy Flag turns OFF when positioning is completed.)
Target speed changed

Timing Chart for Changing Target Position and Target Speed



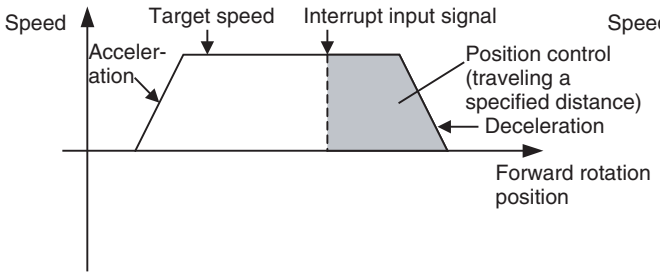
The target position change, is executed according to the position command value when the ABSOLUTE MOVEMENT or RELATIVE MOVEMENT Bit turns ON. In the example here, positioning is performed to 20000 and changing the target position to 30000 is not executed. The target speed can be changed at any time by overwriting the speed command value.

9-5 Interrupt Feeding

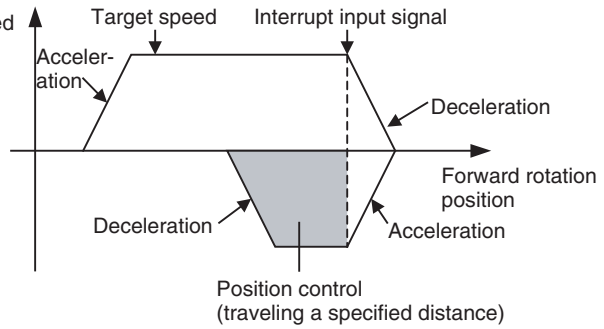
9-5-1 Overview

The PCU's interrupt feeding is a positioning operation that moves the axis for a specified amount, separate from the position command value, from the position at which the external interrupt signal was input either in the same direction as the direction of travel or in the opposite direction. The specified amount of travel is performed at the speed being used when the external interrupt signal was input.

Moving for a Specified Distance in the Direction of Travel



Moving for a Specified Distance in Opposite Direction



When an interrupt input signal is not input, positioning is performed to the target position specified in the position command value, as normal.

9-5-2 Interrupt Feeding Procedure

The interrupt feeding function is a supplementary function for positioning operations using direct operation (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT). Interrupt feeding can be executed using the same procedure as for direct operation by simply specifying interrupt feeding at the start of direct operation.

The following procedure omits the steps up to SERVO LOCK, showing the start procedure only.

1,2,3...

1. Transfer the Servo Parameters for interrupt feeding.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
2. Set the data used for direct operation.
   Set the positioning data for direct operation in the position command value of the Axis Operating Output Memory Area.
   Set the speed data for direct operation in the speed command value of the Axis Operating Output Memory Area.
3. Turn ON the INTERRUPT FEEDING Bit.
4. Start ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

9-5-3 Data Settings for Using Interrupt Feeding

To execute interrupt feeding, the following parameters and data must be set in addition to the parameters and data required for direct operation.

Axis Parameter Area

Interrupt Input Signal Parameters

PCU's address	Contents		Setting
	Bits 08 to 15	Bits 00 to 07	
d	Origin input signal selection	Interrupt input signal selection	Interrupt input signal selection 00: Phase Z 01: External latch signal 1 input 02: External latch signal 2 input 03: External latch signal 3 input

d = 1860 hex + (Axis No. −1) × 14 hex

When using external latch signals 1 to 3, the external latch signal to be used must be allocated in the Servo Drive's external input allocations.

When using a SMARTSTEP Junior Servo Drive, only 00 (phase Z) and 01 (external latch signal 1) can be used for the origin input signal selection.

Servo Parameter Area

Interrupt Feeding Parameters

Parameter name for G Series (Parameter name for W Series)	Unit	Setting range	Parameter size	Default setting	G Series	W Series and SMARTSTEP Junior Series
Final distance for external input positioning (Final travel distance for external positioning)	Command unit	−1,073,741,823 to 1,073,741,823	4	100	Pn203	Pn814

Set the travel distance from the position at which the interrupt input signal is input. The travel direction for when the interrupt input signal is input is determined by the sign (positive or negative) in the set value. The operation performed when the interrupt input signal is input depends on the sign for this parameter and the sign of the position command value for direct operation, as follows:

Position command value for direct operation	Final distance for external input positioning for G Series (Pn203) or Final travel distance for external positioning for W Series (Pn814)	
	Positive value	Negative value
Positive value	When the interrupt input signal is input, interrupt feeding is executed in the same direction as the travel direction when movement was started.	When the interrupt input signal is input, interrupt feeding is executed in the opposite direction from the travel direction when movement was started. (Reversal mode operation)
Negative value	When the interrupt input signal is input, interrupt feeding is executed in the opposite direction from the travel direction when movement was started. (Reversal mode operation)	When the interrupt input signal is input, interrupt feeding is executed in the same direction as the travel direction when movement was started.

Note When using a Position Control Unit with unit version 2.0 or later, the *Final Distance for External Input Positioning* for G-series Servo Drives (Pn203) or *Final Travel Distance for External Positioning* for W-series Servo Drives (Pn814) is used for internal processing in the Position Control Unit for either of the following origin search operation patterns.

- When the origin detection method is set to any value except for 0 (Origin proximity input signal reversal)
- When setting a zero point position offset for an origin search using an absolute encoder

Pn814 is automatically overwritten by the Position Control Unit when the origin search operation is started. If interrupt feeding is used after the origin search, the *Final Distance for External Input Positioning* for G-series Servo Drives (Pn203) or *Final Travel Distance for External Positioning* for W-series Servo Drives (Pn814) must be reset.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
INTERRUPT FEEDING	a	05	1: Enables interrupt feeding

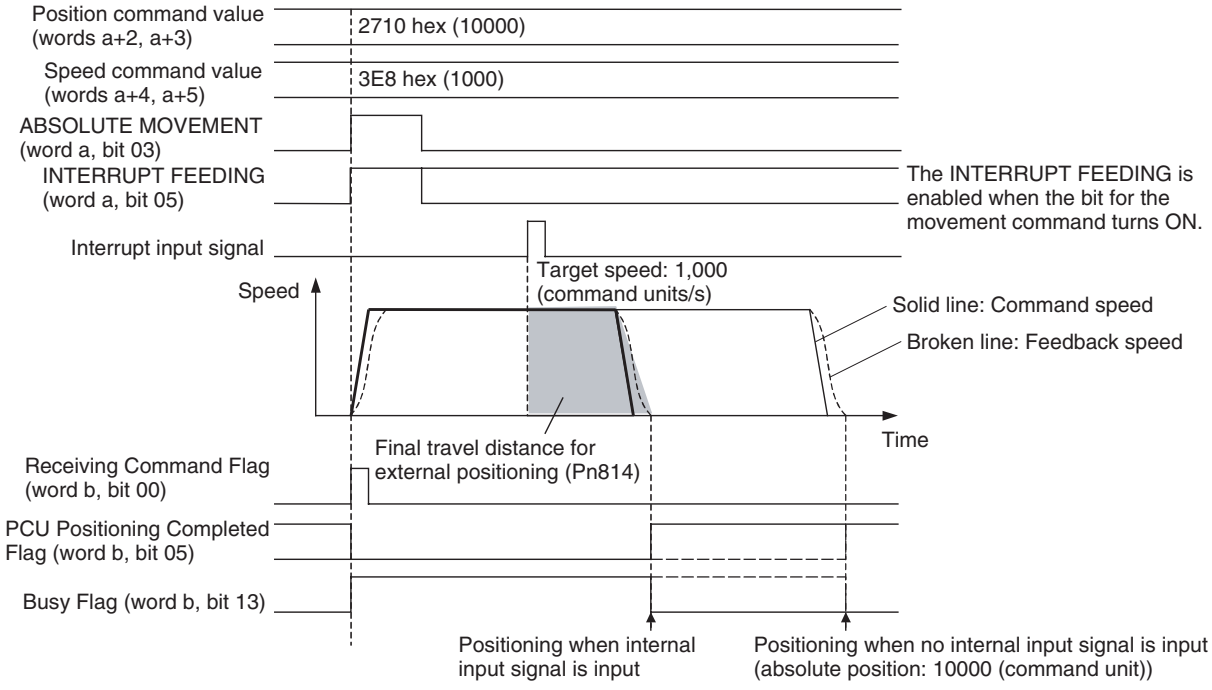
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

9-5-4 Timing Chart for Interrupt Feeding

Interrupt feeding is executed by turning ON the INTERRUPT FEEDING Bit in the Axis Operating Output Area and starting direct operation.

Timing Chart for Interrupt Feeding Using ABSOLUTE MOVEMENT

The following timing chart is for when INTERRUPT FEEDING is executed with ABSOLUTE MOVEMENT. The timing chart for RELATIVE MOVEMENT is the same, except that positioning is executed with the relative position if no interrupt input signal is input.


Position command value (words a+2, a+3)
2710 hex (10000)
Speed command value (words a+4, a+5)
3E8 hex (1000)
ABSOLUTE MOVEMENT (word a, bit 03)
INTERRUPT FEEDING (word a, bit 05)
The INTERRUPT FEEDING is enabled when the bit for the movement command turns ON.
Interrupt input signal
Target speed: 1,000 (command units/s)
Speed
Solid line: Command speed
Broken line: Feedback speed
Time
Final travel distance for external positioning (Pn814)
Receiving Command Flag (word b, bit 00)
PCU Positioning Completed Flag (word b, bit 05)
Busy Flag (word b, bit 13)
Positioning when internal input signal is input
Positioning when no internal input signal is input (absolute position: 10000 (command unit))

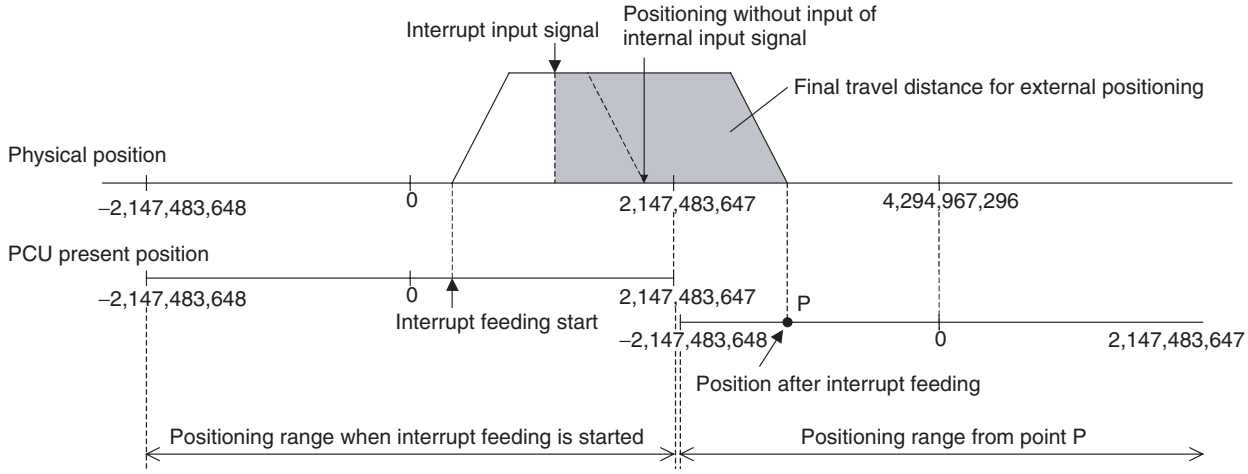
In interrupt feeding as well as normal direct operations, the target position (target position for when no interrupt input signal is input), target speed, and override value can be changed by executing another movement command. Note that, however, in the interval of positioning for the final travel distance for external positioning after the input of the interrupt input signal, another INTERRUPT FEEDING cannot be executed (it will be ignored).

9-5-5 Present Position during Interrupt Feeding

The positioning range for direct operation (ABSOLUTE MOVEMENT and RELATIVE MOVEMENT) is a command present position range of –2,147,483,648 to 2,147,483,647 (command units) when it is not limited by limit input signals or software limits. (For details on the command present position, refer to *7-3 Coordinate System and Present Position*. For details on RELATIVE MOVEMENT, refer to *Executing RELATIVE MOVEMENT* in *9-4-1 Starting Direct Operation*.)

When INTERRUPT FEEDING is executed, the positioning range and position command value setting range are the same, but the positioning range is subject to the following conditions when interrupt input signals are input near the upper limit/lower limit of the positioning range.

When the interrupt feeding operation after interrupt input exceeds the upper or lower limit of the positioning range due to the *Final Travel Distance for External Positioning* setting and the input position of the interrupt input signal, the current position reference point (i.e., the origin) and the positioning range change and positioning to the original position is no longer possible.



When interrupt feeding is used, set the limit inputs, software limits, and other required settings, and make sure that the positioning range is not exceeded due to the interrupt feeding operation.

9-6 Torque Limit Function

When using a W-series Servo Drive, set Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405), and turn ON the Forward Rotation External Current Limit Designation Bit and Reverse Rotation External Current Limit Designation Bit in the Axis Operating Output Memory Area when starting a direct operation to apply a current (torque) limit during direct operation.

When using a G-series Servo Drive, set Servo Parameter *No. 2 Torque Limit* (Pn05F) and turn ON the Forward Rotation External Current Limit Designation Bit and Reverse Rotation External Current Limit Designation Bit in the Axis Operating Output Memory Area when starting a operation to apply a current or torque limit during direct operation.

The Current Limit Designation Bit can also be turned ON during direct operation started without turning ON the Current Limit Designation Bits. If another direct operation command is executed at this point, the torque limit function can be switched during operation.

For further details on the torque limit function, refer to *10-4 Torque Limits*.

The SMARTSTEP Junior Servo Drives do not support torque control.

9-7 Linear Interpolation

With unit version 1.1 or later of the Position Control Unit, a linear interpolation function that can perform linear interpolation using multiple axes in combination has been added.

Linear interpolation can be executed for the axes of a Servo Drive connected to the Position Control Unit, using up to four axes in any combination for axes 1 to 4 or axes 5 to 8.

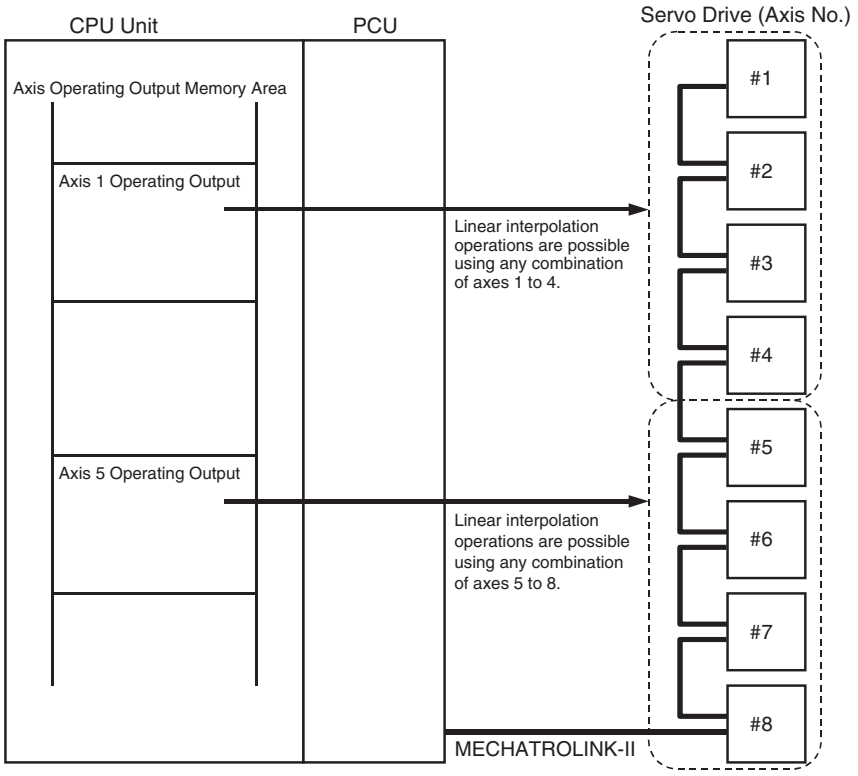
Note Do not write data to the CJ1W-NC□71 unit version 1.1 or later that has been backed up from the CJ1W-NC□71 unit version 1.0 to a Memory Card in the CPU Unit (using either the CPU Unit's simple backup function or the Position Control Unit's backup function). When unit version 1.0 backup data is restored to unit version 1.1 or later, the linear interpolation function cannot be used. To transfer unit version 1.0 settings to unit version 1.1 or later, use the parameter transfer function using the READ DATA, WRITE DATA, or SAVE DATA Bit in the Common Operating Memory Area.

9-7-1 Overview of Linear Interpolation Function

Linear interpolation operates according to the following settings data for axes 1 to 4 or axes 5 to 8.

- Designation of axes to combine for linear interpolation (Interpolation axis designation)
- Position command values for individual interpolation axes
- Designation of absolute and relative positions for position command values for individual interpolation axes (interpolation position designation)
- Interpolation speed command values and speed command values for individual interpolation axes
- Interpolation acceleration and deceleration times

Based on these commands, the respective linear interpolation operations are started by the LINEAR INTERPOLATION START Bit allocated in the Axis Operating Output Memory Area (axis 1 for interpolation operations using axes 1 to 4, and axis 5 for interpolation operations using axes 5 to 8).



The speeds for individual axes in linear interpolation are determined by the following equations. (The same equations are used for 2-axis or 3-axis linear interpolation.)

Example: Linear Interpolation for 4-axis (Axis 1 to Axis 4) Operation

Axis 1 speed = Interpolation speed × Movement of Axis 1 / Total movement

Axis 2 speed = Interpolation speed × Movement of Axis 2 / Total movement

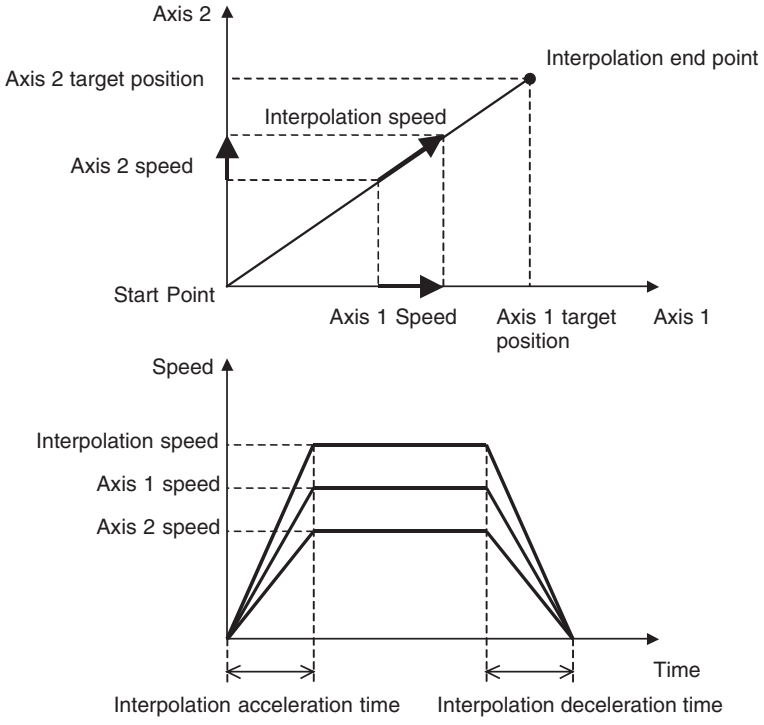
Axis 3 speed = Interpolation speed × Movement of Axis 3 / Total movement

Axis 4 speed = Interpolation speed × Movement of Axis 4 / Total movement

$$\text{Total movement} = \sqrt{(\text{Movement of Axis 1})^2 + (\text{Movement of Axis 2})^2 + (\text{Movement of Axis 3})^2 + (\text{Movement of Axis 4})^2}$$

If speeds set using speed command values for individual interpolation axes are exceeded when interpolation speed command values are resolved into individual axis speeds by the above equations, those speeds are automatically lowered so that each axis involved in linear interpolation is moved at the set speed command value.

Example: Linear Interpolation for 2-axis (Axis 1 and Axis 2) Operation



Note

(1) The interpolation speed, axis 1 speed, and axis 2 speed are the maximum speeds for executing linear interpolation operations without exceeding their respective speed command values.

(2) The *Second-step Linear Acceleration Constant* for W-series Servo Drives (Pn80B) or *Linear Acceleration Constant* for G-series Servo Drives (Pn107) and *Second-step Linear Deceleration Constant* for W-series (Pn80E) or *Linear Deceleration Constant* for G-series Servo Drives (Pn10A) in the Axis Servo Parameters are used for axis acceleration/deceleration operations for the set interpolation acceleration and deceleration times for linear interpolation in Position Control Unit. The setting unit for the Second-step Linear Acceleration Constant and Second-step Linear Deceleration Constant is 10,000 command units/s^2. In operation, the actual acceleration and deceleration times are thus affected by the precision of the command unit.

9-7-2 Linear Interpolation Operation Procedure

Just as with direct operation (absolute and relative movement commands), linear interpolation is executed by setting operation commands in the Axis Operating Output Memory Area.

Common commands for linear interpolation operations, such as designation of interpolation axis combinations, interpolation speeds, and interpolation acceleration and deceleration times, are set in the Axis Operating Output Memory Area for axis 1 or axis 5, and position and speed command values for individual linear interpolation axes are set in the Axis Operating Output Memory Area for those particular axes. Then linear interpolation operations are started by using the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits.

The following procedure describes the steps related to starting linear interpolation operations, from servolock onwards.

1,2,3... 1. Set the data for linear interpolation operation.
Set the axis combination designation, the absolute and relative positioning designation for individual interpolation axes, the interpolation acceleration and deceleration times, and the interpolation speed command value in the Axis Operating Output Memory Area for axis 1 (when using any combination of axes 1 to 4 for linear interpolation) or axis 5 (when using any combination of axes 5 to 8 for linear interpolation).

↓

2. Set the data for individual axis interpolation operations.

In the Axis Operating Output Memory Area, for each axis specified for interpolation, set the position data in the position command value and the speed data in the speed command value.

↓

3. Set linear interpolation.
Turn ON the LINEAR INTERPOLATION SETTING Bit in the Axis Operating Output Memory Area for axis 1 (or axis 5).

↓

4. Start linear interpolation operation.
Turn ON the LINEAR INTERPOLATION START Bit in the Axis Operating Output Memory Area for axis 1 (or axis 5).

Note (1) When the linear interpolation function is used, set the communications cycle (PCU address 1856 hex: bits 07 to 00) in the MECHATROLINK communications settings in the CPU's Common Parameter Area to a value at least one greater than the normal minimum value. If the communications cycle is set too low, the command response times for PCU functions may become too long.

(2) From the point where linear interpolation is first set until axis operation is finished (i.e., while the LINEAR INTERPOLATION SETTING Bit is ON or until the Linear Interpolation Executing Flag turns OFF), command response times for the other axes not involved in the linear interpolation are delayed by up to four communications cycles per combination of axes executing linear interpolation.

9-7-3 Setting Data for Linear Interpolation Operation

PCU linear interpolation operations can be executed simultaneously for two combinations of axes, from axes 1 to 4 and axes 5 to 8. For a combination of axes 1 to 4, set the following linear interpolation-related data in the Axis 1 Operating Output Memory Area, and for a combination of axes 5 to 8 set the data in the Axis 5 Operating Output Memory Area.

- Interpolation acceleration and deceleration times
- Interpolation axis designation
- Interpolation position designation
- Interpolation speed command value

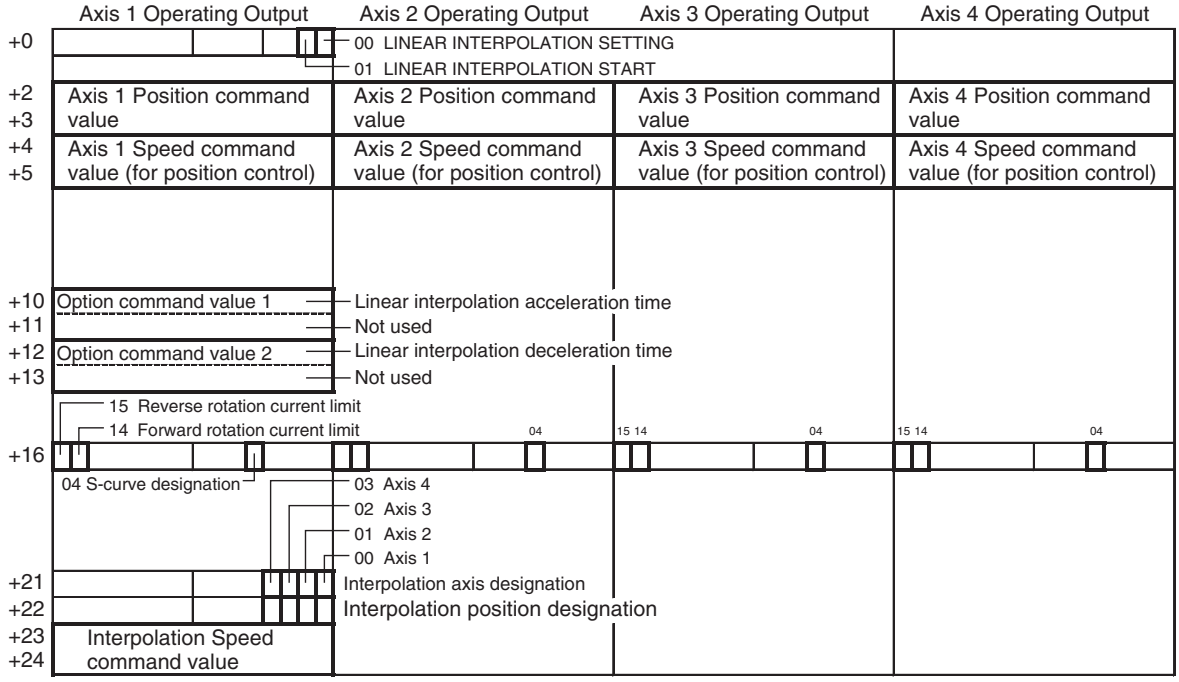
Also, in the Axis Operating Output Memory Area for each axis, make the following settings related to individual axes specified for linear interpolation.

- Position command value (Command value absolute and relative positions are handled according to the interpolation position designation.)
- Speed command value (Functions as the maximum speed designation for individual interpolation axes, with respect to the interpolation speed command value.)

Once the above settings have been made, then execute linear interpolation operations by using the following two bits allocated in the Axis Operating Output Memory Area for axis 1 or axis 5.

- LINEAR INTERPOLATION SETTING
- LINEAR INTERPOLATION START

Example: Linear Interpolation for 4-axis (Axis 1 to Axis 4) Operation



Note

(1) When executing interpolation operations using a combination of axes 5 to 8, the interpolation axis designation and interpolation position designation are made for axes 5 to 8 respectively in the Axis 5 Operating Output Memory Area, in bits 04 to 07 in the corresponding words in the above diagram.

(2) Set the acceleration/deceleration curve designation (the S-curve designation) and the forward/reverse torque designation for each designated interpolation axis.

Common Parameter Area **MECHATROLINK Communications Settings**

PCU's address	Contents		Setting
	Bits 08 to 15	Bits 00 to 07	
1856 hex	Transfer cycle	Communications cycle	Set the communications cycle to a value one greater than the minimum communications cycle value determined by the number of connected devices. (Refer to *6-2-3 MECHATROLINK Communications Settings*.)

Servo Parameter Area **Acceleration/Deceleration Constants**

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/deceleration constants	Pn80C	Acceleration constant switching speed	100 command units/s	Must be set to 0.	2	0
	Pn80F	Deceleration constant switching speed	100 command units/s	Must be set to 0.	2	0

Note When executing linear interpolation operations, the Acceleration Constant Switching Speed (Pn80C) and the Deceleration Constant Switching Speed (Pn80F) in the Servo Parameter Area must each be set to 0. Linear interpolation operations cannot be properly executed if any number other than 0 is set. Linear interpolation operations can be executed for this PCU only with a 1-step acceleration/deceleration curve.

Axis Operating Output Memory Areas (Operating Commands)

Settings for Linear Interpolation Operations: Axis 1, Axis 5 Operating Output Memory Areas

Name	Word	Bits	Contents
LINEAR INTERPOLATION SETTING	a	00	0 → 1: Starts linear interpolation setting 1: LINEAR INTERPOLATION START valid.
LINEAR INTERPOLATION START		01	0 → 1: Starts linear interpolation movement (Valid only when LINEAR INTERPOLATION SETTING = 1)
Option Command Value 1	a+10	---	Linear interpolation acceleration time Unit: ms Command range: 0 to 65535 (0000 hex to FFFF hex)
	a+11	---	Not used (Set value disabled.)
Option Command Value 2	a+12	---	Linear interpolation deceleration time Unit: ms Command range: 0 to 65535 (0000 hex to FFFF hex)
	a+13	---	Not used. (Set value disabled.)
Interpolation Axis Designation	a+21	00 to 03 (Axis 1 to Axis 4) 04 to 07 (Axis 5 to Axis 8)	0: Not designated as interpolation axis. 1: Designated as interpolation axis. Designates axes for executing linear interpolation. Combinations of axes 1 to 4 are designated in bits 00 to 03 (Axis 1 Operating Output Memory Area), and combinations of axes 5 to 8 are designated in bits 04 to 07 (Axis 5 Operating Output Memory Area). Bits 00 to 03, and bits 04 to 07, correspond respectively to axes 1 to 4 and axes 5 to 8.
Interpolation Position Designation	a+22	00 to 03 (Axis 1 to Axis 4) 04 to 07 (Axis 5 to Axis 8)	0: Execute interpolation operations using absolute position. 1: Execute interpolation operations using relative position. Specifies, for axes designated by the interpolation axis designation, whether positioning in interpolation operations is to be executed using absolute or relative positions. Positions for axes 1 to 4 are designated in bits 00 to 03 (Axis 1 Operating Output Memory Area), and positions for axes 5 to 8 are designated in bits 04 to 07 (Axis 5 Operating Output Memory Area). These bits correspond respectively to axes 1 to 4 and axes 5 to 8.
Interpolation Speed Command Value	a+23 a+24	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex) For details on speeds for interpolation operations, refer to *Linear Interpolation Operation Speeds* on page 346.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Settings for Interpolation Axis Operations: Axis Operating Output Memory Areas for Axes Designated by Interpolation Axis Designation

Name		Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
Position Command Value		a+2 a+3	---	Position command value (rightmost word) Position command value (leftmost word) Unit: Command unit Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex) The command value is limited by the allowable positioning range. (For details, refer to *9-4-1 Starting Direct Operation*.)	Supported	Supported	Supported
Speed Command Value (for Position Control)		a+4 a+5	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex) For details on speeds for interpolation operations, refer to *Linear Interpolation Operation Speeds* on page 346.	Supported	Supported	Supported
Acceleration/deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/deceleration curve.	Supported	Supported	Not supported
Forward rotation current limit			14	1: Use forward torque limit.	Supported	Supported	Not supported
Reverse rotation current limit			15	1: Use reverse torque limit.	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

The G-series Servo Drives do not support exponential curve designation filters. When using a G-series Servo Drive, do not attempt to use an exponential curve designation filter.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Drive, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

Note

(1) For interpolation acceleration and deceleration time settings, the upper and lower limits for axis acceleration and deceleration speeds are restricted to a range of 1 to 65,535 [×10,000 command units/s^2]. If the acceleration or deceleration speeds calculated from the linear interpolation operation settings for an interpolation axis are extremely low or high, the linear interpolation following may not be correct.

(2) The interpolation acceleration/deceleration times are converted using the unit for the *Second-step Linear Acceleration Constant* for W-series Servo Drives (Pn80B) or *Linear Acceleration Constant* for G-series Servo Drives (Pn107) and *Second-step Linear Deceleration Constant* for W-series (Pn80E) or *Linear Deceleration Constant* for G-series Servo Drives (Pn10A) (10,000 command units/s^2). In operation, the actual acceleration and deceleration times are thus affected by the precision of the command unit.

(3) When executing linear interpolation with an S-curve, set in advance the same *Movement Average Time* for W-series Servo Drives (Pn812) and *Moving Average Time* for G-series Servo Drives (Pn10E) for all designated linear interpolation axes, and designate S-curve interpolation for all the interpolation axes when starting linear interpolation operation. If different movement average times are set for interpolation axes, and the S-curve designation does not match, operation will not be possible using the linear interpolation following.

(4) With linear interpolation operations, an exponential curve cannot be designated. In the acceleration/deceleration curve designation, the designation of an exponential curve will be disabled.

Axis Operating Input Memory Areas (Monitoring)

Linear Interpolation Operation Status: Axis 1, Axis 5 Operating Input Memory Areas

Name	Word	Bits	Contents
Linear Interpolation Setting Completed Flag	b+24	00	0: Linear interpolation setting command reception enabled. 0 to 1: Linear interpolation setting completed. 1: Linear interpolation setting completed (setting command reception disabled).
Linear Interpolation Executing Flag		13	1: Linear interpolation operation executing

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Interpolation Axis Operation Status: Axis Operating Input Memory Areas for Axes Designated by Interpolation Axis Designation

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 to 1: Command reception started. 1: Receiving command (command reception disabled).
PCU Positioning Completed Flag		05	0 to 1: Positioning is completed.
No Origin Flag		06	0: Origin established. 1: No origin established.
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing)
Feedback Present Position	b+6 b+7	---	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
Command Present Position	b+8 b+9	---	Present position: Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

When a linear interpolation operation command (LINEAR INTERPOLATION SETTING or LINEAR INTERPOLATION START) is executed, the linear interpolation operation status can be checked in the Axis Operating Input Memory Area of the axis (Axis 1 or Axis 5) for which the command was executed. The operation status of axes designated by linear interpolation designation can be checked in the Axis Operating Input Memory Areas for individual interpolation axes.

9-7-4 Linear Interpolation Operation

After the data related to linear interpolation has been set, linear interpolation operation is started by means of the following two operations.

Executing LINEAR INTERPOLATION SETTING

Turn ON the LINEAR INTERPOLATION SETTING Bit in the Axis 1 (or Axis 5) Operating Output Memory Area.

When this bit is turned ON, the settings for linear interpolation operation that have been set in the Axis Operating Output Memory Area for axis 1 (or axis 5) are obtained, along with the position command values and position speed values for individual interpolation axes, and preparations will be executed for linear interpolation operation. Execute LINEAR INTERPOLATION SETTING when the Linear Interpolation Setting Completed Flag in the Axis Operating Input Memory Area for axis 1 (or axis 5), and the Busy Flag and Error Flag for the axes designated by the interpolation axis designation, are reset. If the Linear Interpolation Setting Completed Flag for axis 1 (or axis 5) is set, or if an axis designated by the interpolation axis designation is busy (i.e., Busy Flag ON), or if an error has occurred (i.e., Error Flag ON), the LINEAR INTERPOLATION SETTING command will be ignored and will not be executed.

When LINEAR INTERPOLATION SETTING has been successfully completed, the Linear Interpolation Setting Completed Flag for axis 1 (or axis 5) will be set.

Note

(1) LINEAR INTERPOLATION SETTING is automatically written from the PCU to the Servo Parameters. When executing LINEAR INTERPOLATION SETTING, do not execute any of the Servo Parameter transfer operations (WRITE, READ, or SAVE).

(2) When LINEAR INTERPOLATION SETTING is executed, the *Second-step Linear Acceleration Constant* for W-series Servo Drives (Pn80B) or *Linear Acceleration Constant* for G-series Servo Drives (Pn107) and *Second-step Linear Deceleration Constant* for W-series (Pn80E) or *Linear Deceleration Constant* for G-series Servo Drives (Pn10A) parameters in the Servo Parameters are changed. Be careful of changes to acceleration and deceleration speed settings if interpolation axes are operated independently (by direct operation, JOG, etc.) after LINEAR INTERPOLATION SETTING has been executed (regardless of whether LINEAR INTERPOLATION START has been executed). Change the *Second-step Linear Acceleration Constant* for W-series Servo Drives (Pn80B) or *Linear Acceleration Constant* for G-series Servo Drives (Pn107) and *Second-step Linear Deceleration Constant* for W-series (Pn80E) or *Linear Deceleration Constant* for G-series Servo Drives (Pn10A) as required, by using a WRITE SERVO PARAMETERS command.

Executing LINEAR INTERPOLATION START

Turn ON the LINEAR INTERPOLATION START Bit in the Axis 1 (or Axis 5) Operating Output Memory Area. Linear interpolation operation will start, based on the settings from when the LINEAR INTERPOLATION SETTING Bit was turned ON just before. If the LINEAR INTERPOLATION SETTING Bit is OFF, LINEAR INTERPOLATION START will be disabled.

Execute LINEAR INTERPOLATION START when the Linear Interpolation Executing Flag in the Axis Operating Input Memory Area for axis 1 (or axis 5), and the Busy Flag and Error Flag for the axes designated by the interpolation axis designation, are reset. If the Linear Interpolation Setting Executing for axis 1 (or axis 5) is set, or if an axis designated by the interpolation axis designation is busy (i.e., Busy Flag ON), or if an error has occurred (i.e., Error Flag ON), the LINEAR INTERPOLATION START command will be ignored and will not be executed.

Note

(1) From the time that the LINEAR INTERPOLATION SETTING Bit turns ON until the LINEAR INTERPOLATION START Bit turns ON, do not make changes to any data related to linear interpolation operations. In addition, do not make any changes to speed command values for individual axes while linear interpolation operations are in progress (i.e., while the Busy Flag for any interpolation axis is ON).

(2) For an axis designated as 0 (absolute position) by the interpolation position designation, the origin must be established. If the origin is not established (i.e., if the No Origin Flag is ON), a Present Position Unknown Error (axis error code: 3030) will occur when LINEAR INTERPOLATION START is executed (i.e., when linear interpolation operation is started), and the axis will not be operated. At that time, the other interpolation axes will also be decelerated to a stop.

Example: Linear Interpolation Operation.

The basic flow of operations for linear interpolation is shown below.

In this example, “a” indicates the beginning word of the Axis Operating Output Memory Area for axis 1 when a combination of axes 1 to 4 is used for linear interpolation, and axis 5 when a combination of axes 5 to 8 is used. Likewise, “b” indicates the beginning word of the Axis Operating Input Memory Area for axis 1 when a combination of axes 1 to 4 is used, and axis 5 when a combination of axes 5 to 8 is used.

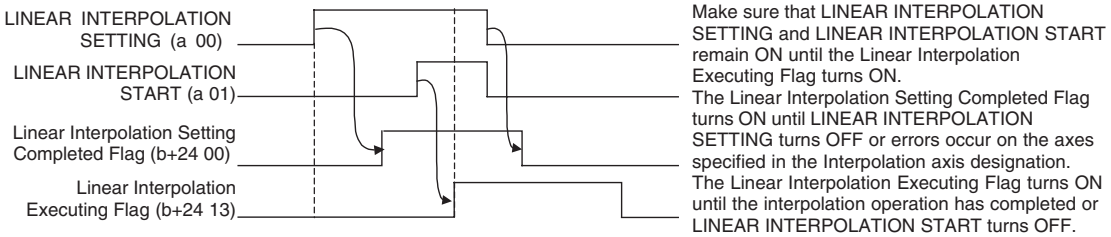
1,2,3...

1. With the bits in the interpolation axis designation (word a+21), designate the axes to be combined for the linear interpolation operation.
2. With the bits in the interpolation position designation (word a+22), designate either absolute or relative position for the position command values for the axes designated as interpolation axes.
3. With the interpolation speed command value (words a+23, a+24), designate the interpolation speed (i.e., the integrated speed). With the speed command values for the axes designated as interpolation axes, designate the maximum speed for each axis.
   For details on the relation between linear interpolation operation speeds and interpolation speed command values and individual axis speed command values, refer to the *Linear Interpolation Operation Speeds* on page 346.
4. With option command value 1 (word a+10) and option command value 2 (word a+12), set the interpolation acceleration time and the interpolation deceleration time.
5. Turn ON the LINEAR INTERPOLATION SETTING Bit (word a, bit 00).
6. When the linear interpolation operation settings have been completed, the Linear Interpolation Setting Completed Flag (word b+24, bit 00) will turn ON.

7. After the above settings have been completed, turning ON the LINEAR INTERPOLATION START Bit (word a, bit 01) while the LINEAR INTERPOLATION SETTING Bit (word a, bit 00) is still ON will start positioning for the designated axes, to the position designated in the interpolation position designation.
   during the linear interpolation operation, the Linear Interpolation Executing Flag (word b+24, bit 13) will turn ON. When executing a linear interpolation operation, leave the LINEAR INTERPOLATION SETTING Bit and the LINEAR INTERPOLATION START Bit ON until the Linear Interpolation Executing Flag turns ON.

Timing Charts

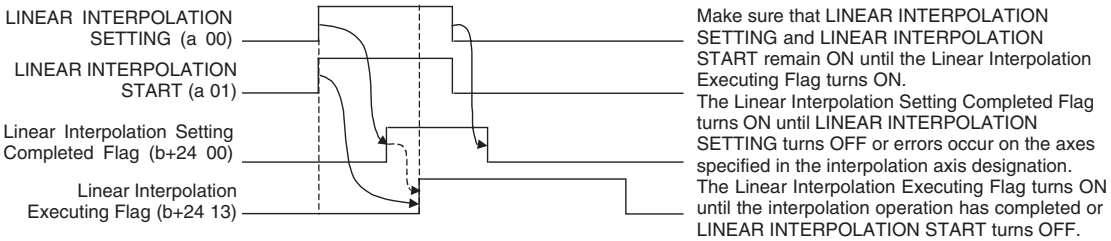
- When LINEAR INTERPOLATION START is Executed After Linear Interpolation Settings are Completed


LINEAR INTERPOLATION SETTING (a 00)
LINEAR INTERPOLATION START (a 01)
Linear Interpolation Setting Completed Flag (b+24 00)
Linear Interpolation Executing Flag (b+24 13)
Make sure that LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START remain ON until the Linear Interpolation Executing Flag turns ON.
The Linear Interpolation Setting Completed Flag turns ON until LINEAR INTERPOLATION SETTING turns OFF or errors occur on the axes specified in the Interpolation axis designation.
The Linear Interpolation Executing Flag turns ON until the interpolation operation has completed or LINEAR INTERPOLATION START turns OFF.

a = Beginning Word of Axis 1 (Axis 5) Operating Output Memory Areas
b = Beginning Word of Axis 1 (Axis 5) Operating Input Memory Areas

If the LINEAR INTERPOLATION SETTING Bit turns OFF before LINEAR INTERPOLATION START is executed, LINEAR INTERPOLATION START is disabled.

- When LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START are Executed Simultaneously


LINEAR INTERPOLATION SETTING (a 00)
LINEAR INTERPOLATION START (a 01)
Linear Interpolation Setting Completed Flag (b+24 00)
Linear Interpolation Executing Flag (b+24 13)
Make sure that LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START remain ON until the Linear Interpolation Executing Flag turns ON.
The Linear Interpolation Setting Completed Flag turns ON until LINEAR INTERPOLATION SETTING turns OFF or errors occur on the axes specified in the interpolation axis designation.
The Linear Interpolation Executing Flag turns ON until the interpolation operation has completed or LINEAR INTERPOLATION START turns OFF.

a = Beginning Word of Axis 1 (Axis 5) Operating Output Memory Areas
b = Beginning Word of Axis 1 (Axis 5) Operating Input Memory Areas

If the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits are turned ON simultaneously, the linear interpolation operation is started after the linear interpolation settings are completed.

Note

(1) The same LINEAR INTERPOLATION START cannot be executed again with a new command while linear interpolation operation is in progress (i.e., while the Linear Interpolation Executing Flag is ON). If it is executed again, it is disabled. It is possible, however, to start an independent linear interpolation for a combination of axes 1 to 4, or of axes 5 to 8, while an operation involving the other combination is already in progress.

(2) While a linear interpolation operation is in progress, do not make changes to the speed command value for any axis involved in that operation (i.e., for any axis designated in the interpolation axis designation). If a speed command value is changed during operation, the operation will not be executed correctly.

If direct operation (absolute movement or relative movement) is executed for an axis designated in the interpolation axis designation while a linear interpolation operation is in progress, that axis will start operation separately from the linear interpolation operation. The acceleration and deceleration speeds at that time will follow the acceleration and deceleration speeds set by the execution of LINEAR INTERPOLATION SETTING (determined from the speed resolved with the interpolation acceleration and deceleration times). The Linear Interpolation Executing Flag will stay ON, however, until the operations of all the originally designated interpolation axes (including this axis) are completed, or until the LINEAR INTERPOLATION START Bit turns OFF.

If MECHATROLINK communications are interrupted while the Linear Interpolation Setting Completed Flag and the Linear Interpolation Executing Flag are ON, the flags will hold their status until MECHATROLINK communications are resumed, regardless of the status of the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits.

Linear Interpolation Operation Speeds

There are two types of settings related to linear interpolation operation speeds: interpolation speed command values and speed command values for individual axes designated by the interpolation axis designation.

The interpolation speed command value designates the integrated speed for linear interpolation. This command value is resolved for the individual interpolation axes and becomes the speed command value for each axis.

The speed command values for individual axes at the time of linear interpolation operation, on the other hand, are the maximum speed settings for the individual axes. For all of the interpolation axes, the linear interpolation speed is lowered so that the speed resolved from the interpolation speed command value does not exceed this set value. (The axis with the longest movement time is operated at 100% of the speed command value, and the speeds for the other axes are lowered in order to perform the linear interpolation.)

Example

2-axis interpolation (axis 1 and axis 2), with target positions of 3,000 and 4,000 (command units) respectively, and with relative positioning designated and the following speed command values set:

Interpolation speed command value: 2,000 (command units/s)

Axis 1 speed command value: 600 (command units /s)

Axis 2 speed command value: 1,000 (command units /s)

The speeds resolved from the interpolation speed command value (in command units/s) are 1,200 for axis 1 and 1,600 for axis 2, but for linear interpolation operation the speeds are reduced to the following values in order for the maximum speeds set by the speed command values for individual axes to not be exceeded.

Interpolation speed command value: 1,000 (command units/s)

Axis 1 speed command value: 600 (command units/s)

Axis 2 speed command value: 800 (command units/s)

If a speed command value for an individual axis is set to 0, no maximum speed limit will set for that interpolation axis and the speed resolved from the interpolation speed command value will be used as is.

If the interpolation speed command value is set to 0, there is no interpolation speed designation and the interpolation speed is determined by the speed command values for the individual interpolation axes.

If either the interpolation speed command value or a speed command value for an individual interpolation axis is set to 0, the individual interpolation axes are operated at the same speed, at the minimum unit (1 command unit/s) for the speed command value.

If less than the minimum unit (1 command unit/s) for an individual axis speed command value results when the interpolation speed command value is resolved for individual interpolation axes, that axis will be operated at the minimum unit (1 command unit/s) for the speed command value.

Note Do not use an override during linear interpolation operation. The linear interpolation operation will not be executed correctly if an override is used.

Stopping during Linear Interpolation

If a stop command, error, or Servo unlock command occurs for one of multiple axes for which linear interpolation is being performed, the operation of the axes will be as follows and the axes will not stop at the same time.

Axis Error Occurs in One of the Interpolated Axes:
The other interpolated axes will be decelerated to a stop when the Error Flag turns ON for the axis in which the error has occurred.

Stop Command Given for One of the Interpolated Axes:
The other interpolated axes will be decelerated to a stop when the Stop Execution Flag turns ON for the axis for which the stop command was given.

Servo Unlock Command Given for One of the Interpolated Axes:
The other interpolated axes will be decelerated to a stop when the Servo ON Flag turns OFF for the axis for which the servo unlock command was given.

If a stop command is given for only one axis to stop a linear interpolation operations, the axes will not stop at the same time, as described above. To stop all of the interpolated axes at the same time, stop commands must be given for all interpolated axes at the same time.

If an alarm in the Servo Drive results in an axis error, the axis for which the error occurred will be stopped according to the stop method set in the Servo Drive, but the other interpolated axes will be decelerated to a stop. The distances required to stop will thus be different.

SECTION 10
Other Operations

This section describes the following operations: servo lock/unlock, jogging, override, torque limits, speed control, torque control, backlash compensation, software limits, and stop functions.

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10-1 Servo Lock/Unlock

10-1-1 Overview

The Servo lock/unlock function either creates a Servo Drive position loop (SERVO LOCK) or releases the position loop (SERVO UNLOCK).

10-1-2 Servo Lock/Unlock Operation

The SERVO LOCK/UNLOCK operations start when the SERVO LOCK/UNLOCK Bit in the Axis Operating Output Memory Area turns ON.

When a Servomotor with absolute encoder is used, the absolute value data is read by executing SERVO LOCK. For details, refer to *8-6-6 Establishing the Origin Using an Absolute Encoder*.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
SERVO LOCK	a+1	00	0 → 1: Starts SERVO LOCK.
SERVO UNLOCK		01	0 → 1: Starts SERVO UNLOCK.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Execute SERVO LOCK when the Busy Flag for the corresponding axis is OFF. If SERVO LOCK is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and SERVO LOCK will not be executed. When executing SERVO LOCK, make sure that the SERVO LOCK Bit remains ON until the Receiving Command Flag or Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the SERVO LOCK command will be ignored. Be sure that all of these command bits are OFF before attempting to lock the Servo.

SERVO UNLOCK can be executed in any PCU status. When executing SERVO UNLOCK, make sure that the SERVO UNLOCK Bit remains ON until either the Receiving Command Flag turns ON, or the Busy Flag turns OFF after executing SERVO UNLOCK.

Other axis operation commands will be ignored while SERVO UNLOCK is being executed and while the SERVO UNLOCK Bit is ON.

Note When executing SERVO UNLOCK, the PCU executes DECELERATION STOP for the Servo Drive, followed immediately (without waiting for the axis to stop) by SERVO UNLOCK. If SERVO UNLOCK is executed during axis operation, the corresponding axis will be put in Servo free run state. Therefore, prevent the machine from moving due to momentum by using the dynamic brake or executing DECELERATION STOP before executing SERVO UNLOCK to stop axis operation. Movement of the machine due to momentum may result in damage to the machine or an accident. When executing SERVO UNLOCK during speed control or torque control, the Servo Drive will recover in the position control mode's Servo lock status the next time SERVO LOCK is executed.

Axis Operating Input Memory Areas (Monitoring)

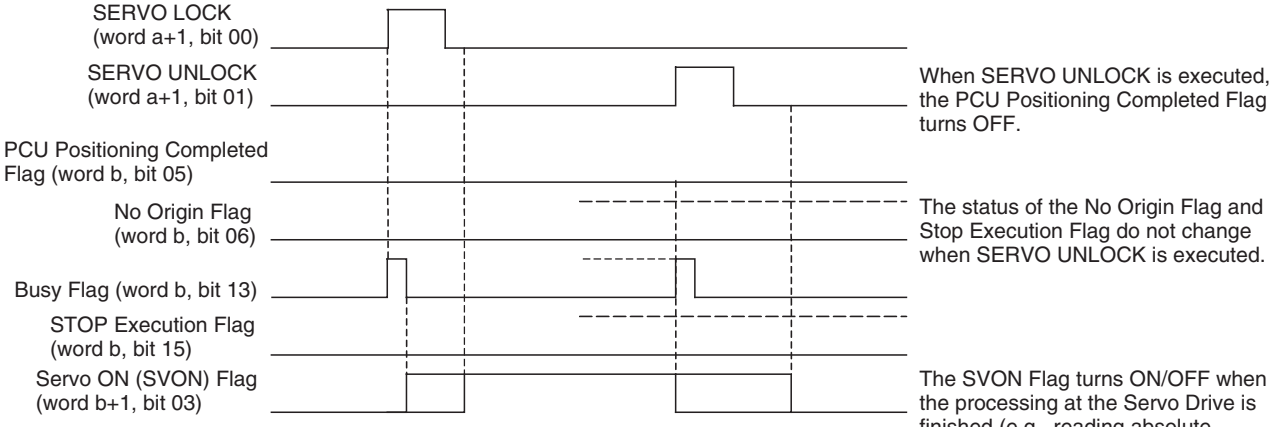
Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Error Flag		12	0: No axis error 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).
SVON (Servo ON) Flag	b+1	03	0: Servo unlocked. 1: Servo locked.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

The Servo lock status of each axis can be confirmed by checking the SVON Flag in the Axis Operating Input Memory Areas.

Timing Chart

The following timing chart is for when SERVO LOCK and SERVO UNLOCK are executed.


SERVO LOCK (word a+1, bit 00)
SERVO UNLOCK (word a+1, bit 01)
PCU Positioning Completed Flag (word b, bit 05)
No Origin Flag (word b, bit 06)
Busy Flag (word b, bit 13)
STOP Execution Flag (word b, bit 15)
Servo ON (SVON) Flag (word b+1, bit 03)
When SERVO UNLOCK is executed, the PCU Positioning Completed Flag turns OFF.
The status of the No Origin Flag and Stop Execution Flag do not change when SERVO UNLOCK is executed.
The SVON Flag turns ON/OFF when the processing at the Servo Drive is finished (e.g., reading absolute encoder data, turning ON brake).

For details on the flag operations when using Servomotors with absolute encoders, refer to *8-6-6 Establishing the Origin Using an Absolute Encoder*.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

10-2 Jogging

10-2-1 Overview of Operation

The axis travels in the specified direction at the specified speed while the JOG Bit is ON, and decelerates to a stop when the JOG Bit turns OFF. Jogging operations can be executed even if the origin has not been established.

10-2-2 Procedure for Jogging Operations

The procedure for using jogging is as follows:

1,2,3...

1. Set the Common Parameters and save them.
2. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters set in step 1 above is enabled.
3. Start MECHATROLINK communications.

4. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute direct operation.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
   To enable changed offline parameters, turn ON the power to the Servo Drive again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
5. Execute SERVO LOCK.
6. Set the data used for the jogging operation.
   Set the jogging operation speed data in the speed command value of the Axis Operating Output Memory Area.
7. Start the jogging operation.

When using the PCU for the first time or to change the Common Parameter data, steps 1 and 2 must be performed. After executing SERVO LOCK, WRITE SERVO PARAMETER can be executed to set the acceleration/deceleration used each time the jogging operation is performed.

Note When specifying the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change parameters during axis operation. Changing parameters while the axis is operating may result in displaced positioning or other malfunction.

10-2-3 PCU Data Settings for Jogging Operations

A simple explanation of the main parameters and data used to execute the jogging operation is provided here. To execute jogging operations, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.

G-series Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
Acceleration/ deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
Acceleration/ deceleration filters	Pn10E	Moving average time	0.1 ms	0 to 5100	2	0

W-series and SMARTSTEP Junior Acceleration/Deceleration Constants

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting	W Series	SMARTSTEP Junior
Acceleration/deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
Acceleration/deceleration filters	Pn810	Exponential acceleration/deceleration bias	Command units/s	0 to 32767	2	0	Supported	Not supported
	Pn811	Exponential acceleration/deceleration time constant	0.1 ms	0 to 5100	2	0	Supported	Not supported
	Pn812	Movement average time	0.1 ms	0 to 5100	2	0	Supported	Not supported

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

Axis Operating Output Memory Areas (Operating Commands)

Name		Word	Bits	Contents	G Series	W Series	SMARTSTEP Junior
JOG		a	09	0 → 1: Starts jogging. 1 → 0: Stops jogging.	Supported	Supported	Supported
Direction designation			10	0: Forward rotation direction 1: Reverse rotation direction	Supported	Supported	Supported
Speed command value		a+4 a+5	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex) The upper limit setting of the speed command value depends on the specifications of the Servo Drive.	Supported	Supported	Supported
Acceleration/deceleration curve designation	Exponential curve designation	a+16	03	1: Use exponential acceleration/deceleration curve.	Not supported	Supported	Not supported
	S-curve designation		04	1: Use S-curve acceleration/deceleration curve.	Supported	Supported	Not supported
Forward rotation current limit			14	1: Use forward torque limit.	Supported	Supported	Not supported
Reverse rotation current limit			15	1: Use reverse torque limit.	Supported	Supported	Not supported

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The direction designation setting when the jogging operation starts (JOG Bit turns ON) is enabled. Even if the designation is changed during jogging, the direction will not change.

The settings for the Acceleration/Deceleration Curve Designation Bit, and Forward/Reverse Rotation Current Limit Designation Bit when jogging starts (JOG Bit turns ON) and stops (JOG Bit turns OFF) are enabled.

The speed command value can always be changed during operation. By overwriting the speed command value, the speed for the jogging operation can be changed.

The G-series Servo Drives do not support exponential curve designation. When using a G-series Servo Drive, do not attempt to use an exponential curve designation.

The SMARTSTEP Junior Servo Drives do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Drive, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

Note Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).
Feedback present position	b+6 b+7	---	Present position Feedback position (rightmost word) Feedback position (leftmost word)
Command present position	b+8 b+9	---	Present position Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

10-2-4 Starting Jogging

Jogging is performed according to the direction designation and speed command value set in the Axis Operating Output Memory Areas and started when the Jog Bit turns ON. Execute JOG when the Busy Flag for the corresponding axis is OFF. If the jogging operation is started while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and JOG will not be executed.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the jog command will be ignored. Be sure that all of these command bits are OFF before attempting a jog operation.

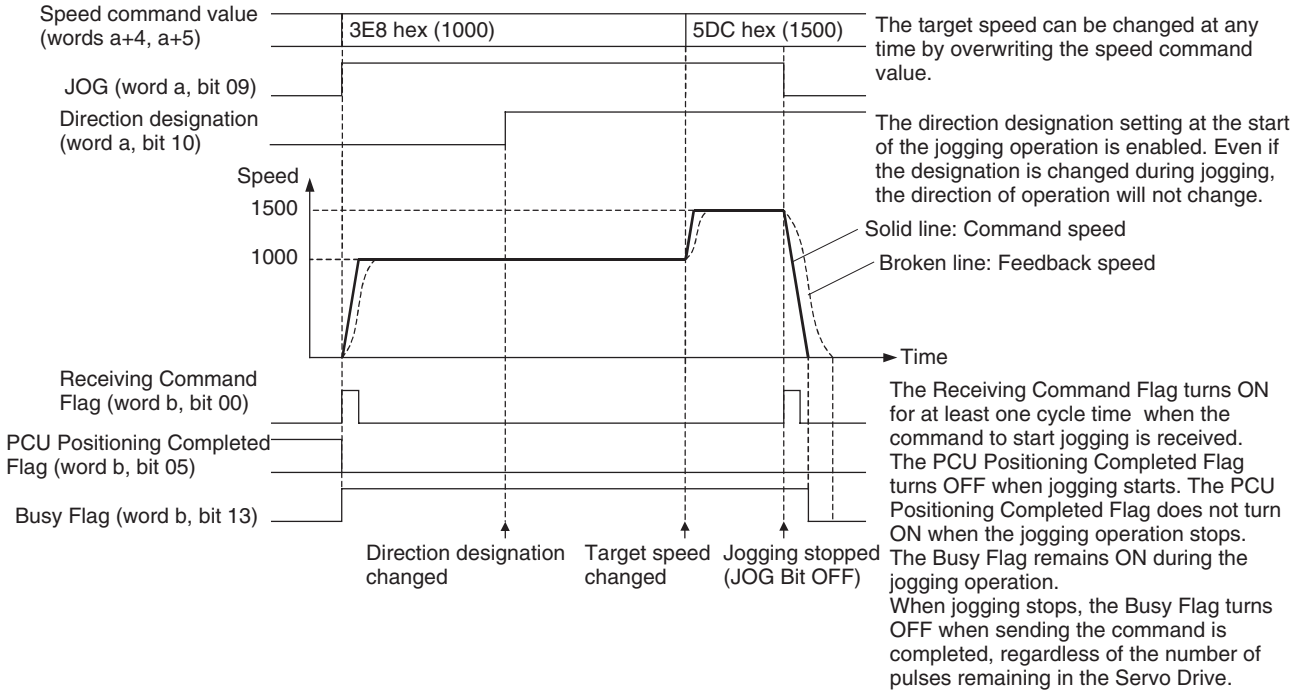
The jogging operation will continue while the Jog Bit is ON. To enable the PCU to receive the JOG command correctly, make sure that the Jog Bit remains ON while the Receiving Command Flag is ON.

The direction designation setting when the jogging operation starts (Jog Bit turns ON) is enabled. Even if the designation is changed during jogging, the direction will not change. Jogging decelerates to a stop when the Jog Bit turns OFF.

The Busy Flag remains ON during the jogging operation. The PCU Positioning Completed Flag does not turn ON when jogging stops.

Timing Chart

The following timing chart is for when JOG is executed in the forward rotation direction.


Speed command value (words a+4, a+5)
3E8 hex (1000)
5DC hex (1500)
The target speed can be changed at any time by overwriting the speed command value.
JOG (word a, bit 09)
Direction designation (word a, bit 10)
The direction designation setting at the start of the jogging operation is enabled. Even if the designation is changed during jogging, the direction of operation will not change.
Speed
1500
1000
Solid line: Command speed
Broken line: Feedback speed
Time
Receiving Command Flag (word b, bit 00)
PCU Positioning Completed Flag (word b, bit 05)
Busy Flag (word b, bit 13)
The Receiving Command Flag turns ON for at least one cycle time when the command to start jogging is received.
The PCU Positioning Completed Flag turns OFF when jogging starts. The PCU Positioning Completed Flag does not turn ON when the jogging operation stops.
The Busy Flag remains ON during the jogging operation.
When jogging stops, the Busy Flag turns OFF when sending the command is completed, regardless of the number of pulses remaining in the Servo Drive.
Direction designation changed
Target speed changed
Jogging stopped (JOG Bit OFF)

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

10-3 Override

10-3-1 Overview

The override operation is used to change the speed of an active axis. While the Override Enable Bit is ON, the target speed is changed by applying the override value that is set in the Axis Operating Output Memory Area.

The override can be set from 0.01% to 327.67% in units of 0.01%. The speed command values (Speed command value for speed control in speed control mode) set for direct operation, origin return, jogging, and speed control operations are taken to be 100%.

The override function is disabled during origin search or torque control.

The target speed when override is enabled is as follows:

$$\text{Target speed} = \text{Speed command value} \times \frac{\text{Override}}{10000}$$

10-3-2 Override Operation

The override function can be used for the following operations.

- Enabling an Override for a Series of Operations

  Set the override beforehand, and execute each operating command with the Override Enable Bit turned ON. The target speed for the operation will be the initial speed command value multiplied by the override.

- Switching between Enabling and Disabling Override during Axis Operation

  When the Override Enable Bit is turned ON for an active axis performing direct operation, origin return, or jogging operation, the speed will change to the above target speed using the acceleration/deceleration set in the Servo Parameters for acceleration/deceleration (the acceleration/deceleration speed enabled for the present operation).

  When using speed control, the speed can be changed without using acceleration/deceleration by using the Override Enable Bit during axis operation, however, the linear acceleration/deceleration curve can be applied to the speed change by setting the *Soft Start Acceleration/Deceleration Time* in the Servo Parameters. (For details on the acceleration/deceleration curve, refer to *7-4 Acceleration and Deceleration Operations*. For details on speed control, refer to *10-5 Speed Control*.)

  If the Override Enable Bit is turned OFF, the speed is changed in the same way as when the Override Enable Bit was ON from the present target speed (speed command value multiplied by override value) to the speed set in the speed command value.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
Override Enable Bit	a	14	0: Override disabled. 1: Override enabled.
Override	a+14	---	Override ratio Unit: 0.01% Command range: 1 to 32,767 (0001 hex to 7FFF hex)

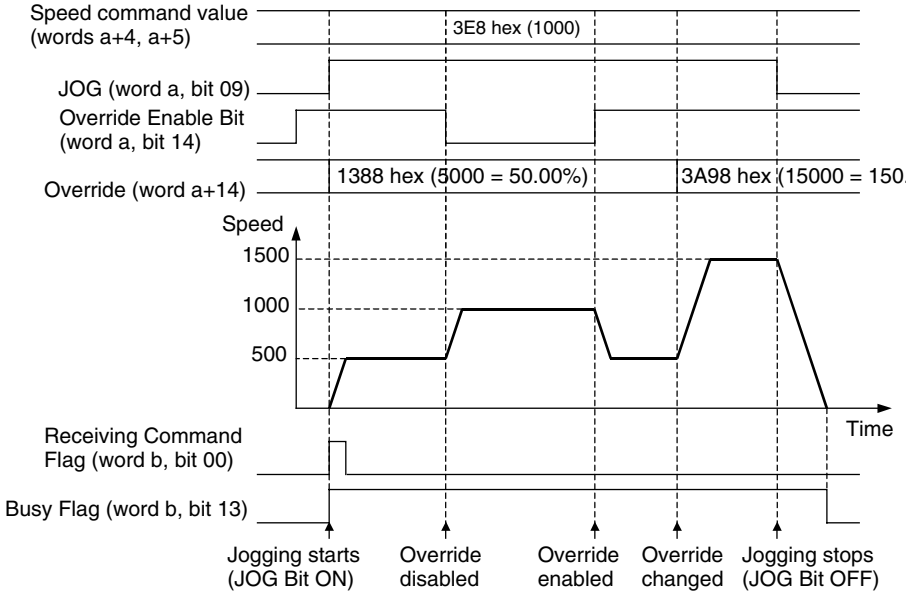
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The override can be set in the range 1 to 32767 (0.01% to 327.67%). The actual Servomotor speed control range and minimum control unit depend on the Servo Drive specifications.

While override is enabled, any changes to the override value are enabled immediately. While override is enabled, the override ratio can be changed during operation by setting a new override value in the Axis Operating Output Memory Area.

Timing Chart

The following timing chart is for when the override function is executed during a jogging operation.



While override is enabled, the target speed is obtained by multiplying the speed command value by the override ratio. Changes to the override value while override is enabled are immediately effective in operations.
The acceleration/deceleration used to change the speed when switching between enabling and disabling override or changing the override value depends on the acceleration/deceleration operation setting for the operation being performed.

The Receiving Command Flag turns ON for at least one cycle time when the command to start axis operation is received. The status of this flag does not change when the override value is changed.
The status of the Busy Flag does not change when switching between enabling or disabling override, or when the override value is changed.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. − 1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

10-4 Torque Limits

10-4-1 Overview

When using a G-series Servo Drive or a W-series Servo Drive, torque limits can be applied to Servomotor axis operation in position control functions (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT), ORIGIN SEARCH, ORIGIN RETURN, JOG, SPEED CONTROL, TORQUE CONTROL, and Stop Functions (DECELERATION STOP, EMERGENCY STOP).

There are two types of torque limit, one that constantly functions for forward and reverse rotation and the other that can be disabled/enabled in operating commands. For speed control, torque limits can also be added to option command values. (For details, refer to *Option Command Value during Speed Control* in *10-5-2 Starting Speed Control*.)

When enabling multiple torque limit functions simultaneously, the Servomotor's output torque is limited by the minimum torque limit setting.

The SMARTSTEP Junior Servo Drives do not support torque control. The following settings and functions cannot be used.

10-4-2 Constant Torque Limits

G-series Servo Drives

To apply a constant torque limit to axis operation, set the Servo Parameters *No.1 Torque Limit* (Pn05E) and *No.2 Torque Limit* (Pn05F). By setting these parameters, the output torque of the operating Servomotor will always be limited by the set ratio of the rated torque. Also by setting the *Torque Limit Selection* (Pn003), the forward torque limit and reverse torque limit will be as shown in the following table.

Parameter No.	Set value	Forward torque limit	Reverse torque limit
Pn003	1	Pn05E	Pn05E
	2	Pn05E	Pn05F

Torque Limit Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn05E	No.1 torque limit	%	0 to 500	2	300
---	Pn05F	No.2 torque limit	%	0 to 500	2	100

W-series Servo Drives

To apply constant torque limits to axis operation, set the Servo Parameters *Forward Torque Limit* (Pn402) and *Reverse Torque Limit* (Pn403). By setting this parameter, the output torque of the operating Servomotor will always be limited by the set ratio of the rated torque.

Torque Limit Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn402	Forward torque limit	%	0 to 800	2	350
---	Pn403	Reverse torque limit	%	0 to 800	2	350

10-4-3 Torque Limits Set by Operating Commands

Torque limit functions set by operating commands are executed by turning ON the Forward/Reverse Rotation Current Limit Bit in the Axis Operating Output Area and starting the operating command. The *Forward/Reverse Rotation Current Limit* setting is enabled when the Start Bit for the operating command turns ON.

When using W-series Servo Drives, the output torque is limited when the Servomotor is operating according to the set values in the Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405) by turning ON the Forward/Reverse Current Limit Designation Bit when using operating commands.

When using G-series Servo Drives, the output torque is limited when the Servo Parameter *Torque Limit Selection* (Pn003) is set to 3. The Forward Rotation Current Limit Designation Bit will be enabled when the PCL is turned ON. The Reverse Rotation Current Limit Designation Bit will be enabled when the NCL is turned ON.

PCL ON: When either the Forward Torque Limit (CN1 PCL: Pin 7) or Axis Output Operating Area is turned ON.

NCL ON When either the Reverse Torque Limit (CN1 NCL: Pin 8) or Axis Output Operating Area is turned ON.

Forward Torque Limit

PCL OFF	PCL ON
Pn05E	Pn05F

Reverse Torque Limit

NCL OFF	NCL ON
Pn05E	Pn05F

A torque limit that has been enabled will continue to function until the Forward/Reverse Current Limit Designation Bit is turned OFF and the next operating command is sent (the specified torque limits continue to be applied even in Servo lock status after positioning stops).

Note If the axis stops due to an error during axis operation with the torque limit function enabled, the torque limit when stopped will depend on the setting of the Forward/Reverse Current Limit Designation Bit. When the Current Limit Designation Bit is turned ON only at the start of axis operation, and turned OFF during axis operation, the torque limit will be disabled if the axis stops due to an error. Make sure that the Current Limit Designation Bit remains ON for the interval that the torque limit needs to be enabled.

The Torque Limit Status Flag in the Servo Status Flags in the Axis Operating Input Memory Area turns ON for the time the torque limit is functioning.

G-series Servo Parameter Area **Torque Limit Parameters**

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn05E	No.1 torque limit	%	0 to 500	2	300
---	Pn05F	No.2 torque limit	%	0 to 500	2	100

W-Series Servo Parameter Area **Torque Limit Parameters**

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn404	Forward rotation external current limit	%	0 to 800	2	100
---	Pn405	Reverse rotation external current limit	%	0 to 800	2	100

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
ABSOLUTE MOVEMENT	a	03	0 → 1: Starts absolute movement.
RELATIVE MOVEMENT		04	0 → 1: Starts relative movement.
ORIGIN SEARCH		06	0 → 1: Starts origin search.
ORIGIN RETURN		07	0 → 1: Starts origin return.
JOG		09	0 → 1: Starts jogging. 1 → 0: Stops jogging
Direction designation		10	0: Forward rotation direction 1: Reverse rotation direction
DECELERATION STOP		15	0 → 1: Starts deceleration stop.
SPEED CONTROL	a+1	02	0 → 1: Starts speed control.
TORQUE CONTROL		03	0 → 1: Starts torque control.
EMERGENCY STOP		15	0 → 1: Starts emergency stop.
Forward rotation current limit designation	a+16	14	1: Use forward torque limit.
Reverse rotation current limit designation		15	1: Use reverse torque limit.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Torque Limit Status Flag	b+1	09	1: Torque limit in progress

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

When using W-series Servo Drives, the set values for Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405) can be overwritten at any time to change the torque limit value while the torque limit function is enabled.

When using G-series Servo Drives, the set values for Servo Parameters *No.1 Torque Limit* (Pn05E) and *No.2 Torque Limit* (Pn05F) can be overwritten at any time to change the torque limit value.

During ABSOLUTE MOVEMENT, RELATIVE MOVEMENT (except for INTERRUPT FEEDING), SPEED CONTROL, and TORQUE CONTROL execution, the Current Limit Designation Bit setting can be changed while the axis is active by turning ON the command's start bit again.

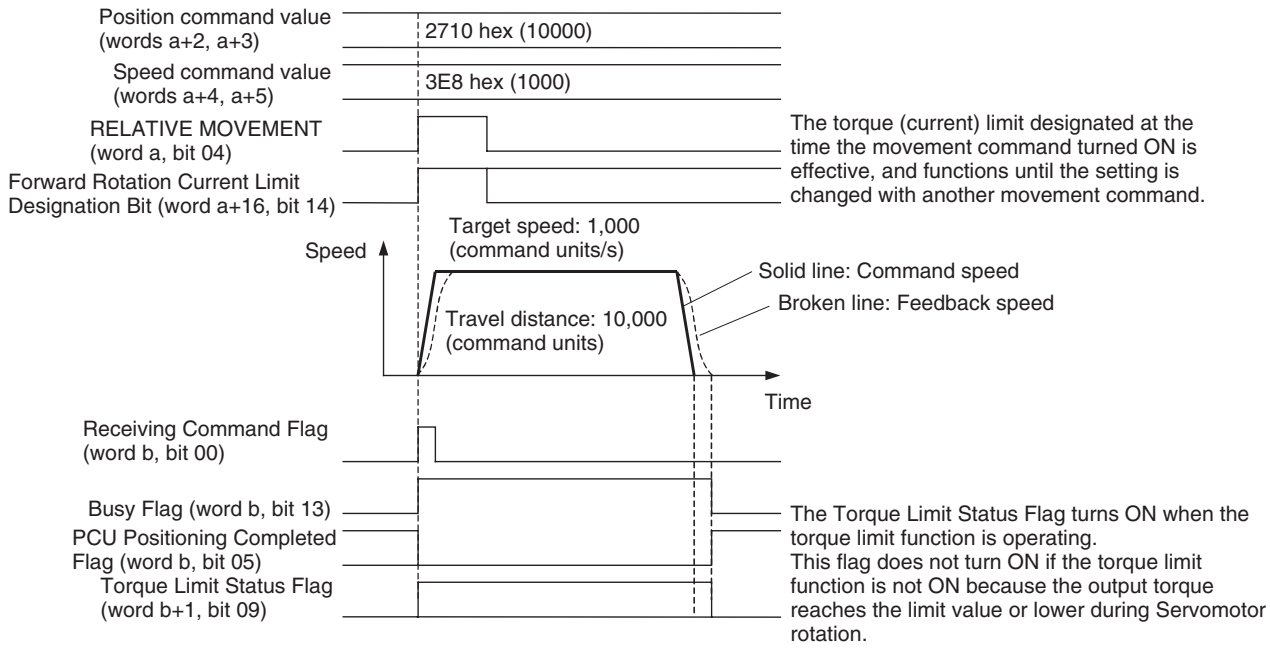
For ORIGIN SEARCH, ORIGIN RETURN, and JOG, torque limits can be specified only at the start of operation.

Note When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

Timing Charts

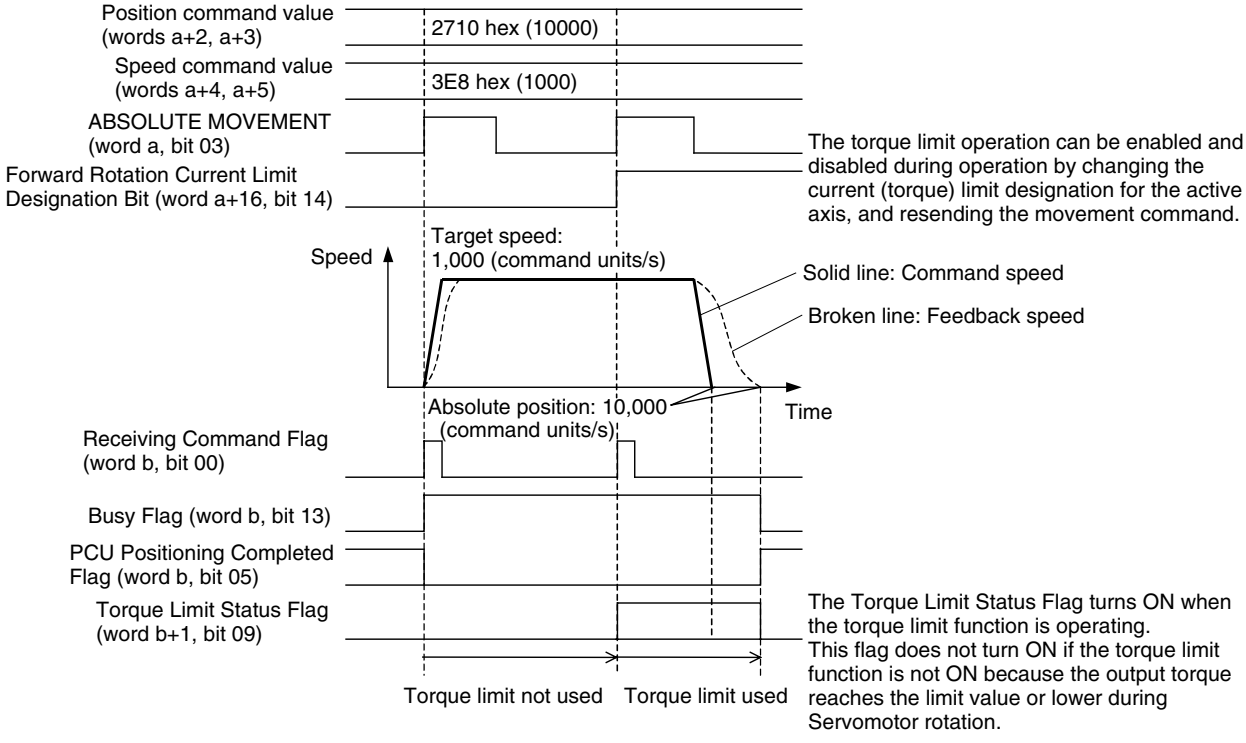
Example: Using Torque Limit during Position Control Execution

The following timing chart is for when RELATIVE MOVEMENT is executed. The timing chart for ABSOLUTE MOVEMENT is the same, except that positioning is executed with the absolute position.


Position command value (words a+2, a+3)
2710 hex (10000)
Speed command value (words a+4, a+5)
3E8 hex (1000)
RELATIVE MOVEMENT (word a, bit 04)
Forward Rotation Current Limit Designation Bit (word a+16, bit 14)
The torque (current) limit designated at the time the movement command turned ON is effective, and functions until the setting is changed with another movement command.
Target speed: 1,000 (command units/s)
Speed
Solid line: Command speed
Broken line: Feedback speed
Travel distance: 10,000 (command units)
Time
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Completed Flag (word b, bit 05)
Torque Limit Status Flag (word b+1, bit 09)
The Torque Limit Status Flag turns ON when the torque limit function is operating.
This flag does not turn ON if the torque limit function is not ON because the output torque reaches the limit value or lower during Servomotor rotation.

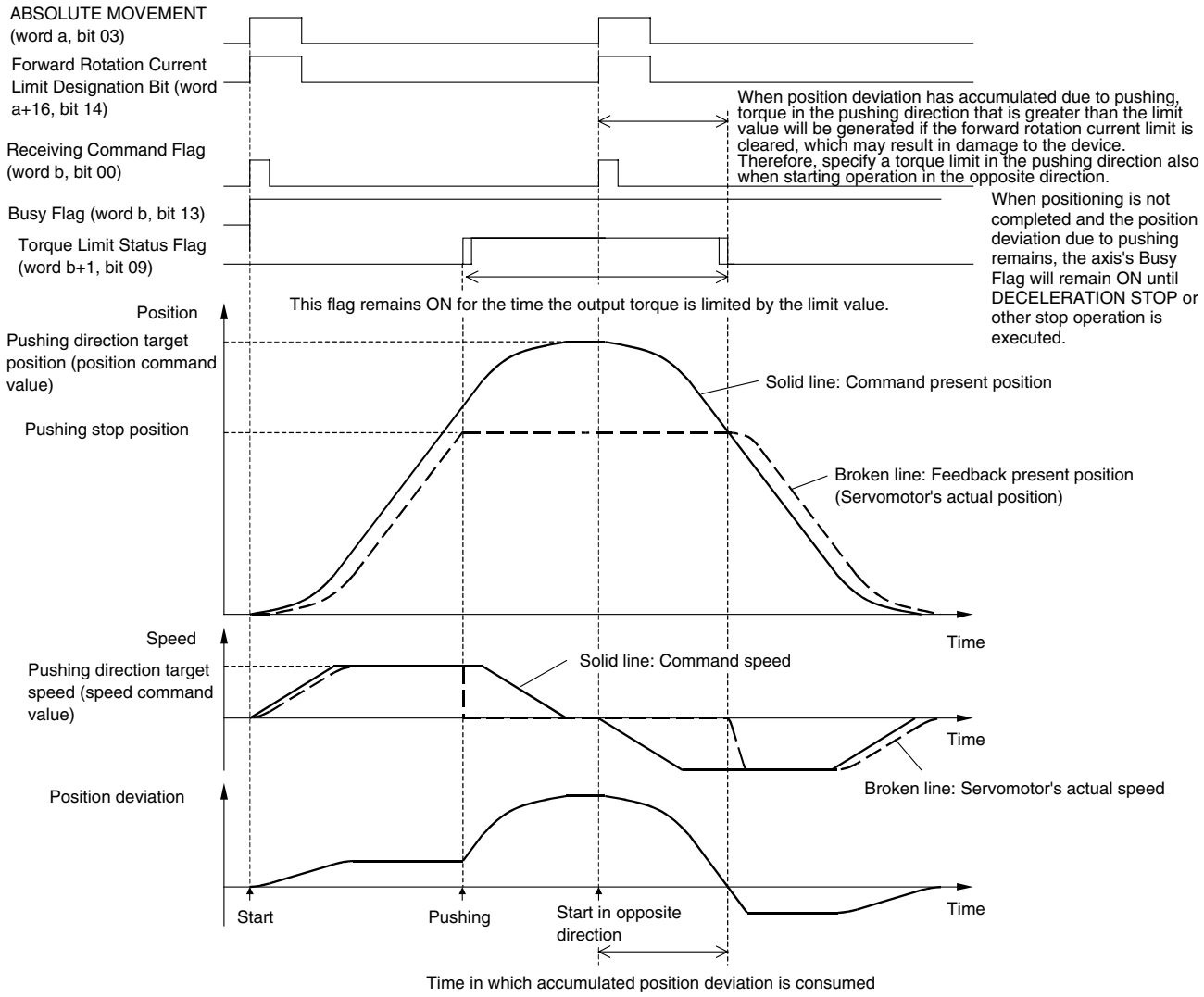
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Example: Enabling Torque Limit during Positioning


Position command value (words a+2, a+3)
2710 hex (10000)
Speed command value (words a+4, a+5)
3E8 hex (1000)
ABSOLUTE MOVEMENT (word a, bit 03)
Forward Rotation Current Limit Designation Bit (word a+16, bit 14)
The torque limit operation can be enabled and disabled during operation by changing the current (torque) limit designation for the active axis, and resending the movement command.
Target speed: 1,000 (command units/s)
Speed
Solid line: Command speed
Broken line: Feedback speed
Absolute position: 10,000 (command units/s)
Time
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
PCU Positioning Completed Flag (word b, bit 05)
Torque Limit Status Flag (word b+1, bit 09)
The Torque Limit Status Flag turns ON when the torque limit function is operating.
This flag does not turn ON if the torque limit function is not ON because the output torque reaches the limit value or lower during Servomotor rotation.
Torque limit not used
Torque limit used

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Positioning that Does Not Reach Target Position (Example: Pushing a Load)


ABSOLUTE MOVEMENT (word a, bit 03)
Forward Rotation Current Limit Designation Bit (word a+16, bit 14)
When position deviation has accumulated due to pushing, torque in the pushing direction that is greater than the limit value will be generated if the forward rotation current limit is cleared, which may result in damage to the device. Therefore, specify a torque limit in the pushing direction also when starting operation in the opposite direction.
Receiving Command Flag (word b, bit 00)
Busy Flag (word b, bit 13)
When positioning is not completed and the position deviation due to pushing remains, the axis's Busy Flag will remain ON until DECELERATION STOP or other stop operation is executed.
Torque Limit Status Flag (word b+1, bit 09)
This flag remains ON for the time the output torque is limited by the limit value.
Position
Pushing direction target position (position command value)
Solid line: Command present position
Pushing stop position
Broken line: Feedback present position (Servomotor's actual position)
Time
Speed
Pushing direction target speed (speed command value)
Solid line: Command speed
Time
Broken line: Servomotor's actual speed
Position deviation
Start
Pushing
Start in opposite direction
Time
Time in which accumulated position deviation is consumed

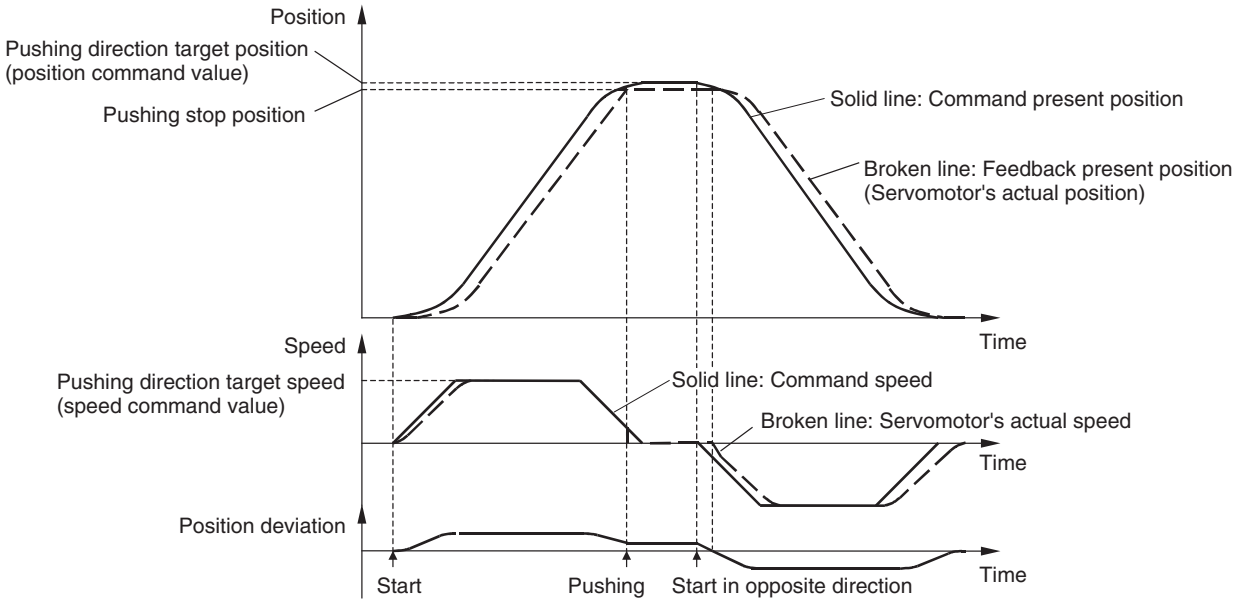
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Note In applications such as pushing a load, when using the torque limit function to limit the output torque of the Servomotor and stop the machine, the command present position reaches the target position while the feedback present position does not, which causes the pulses to accumulate for the position deviation in the Servo Drive's deviation counter. To change movement to the opposite direction, send the operating command with the Current Limit Designation Bit setting enabled in the pushing direction.

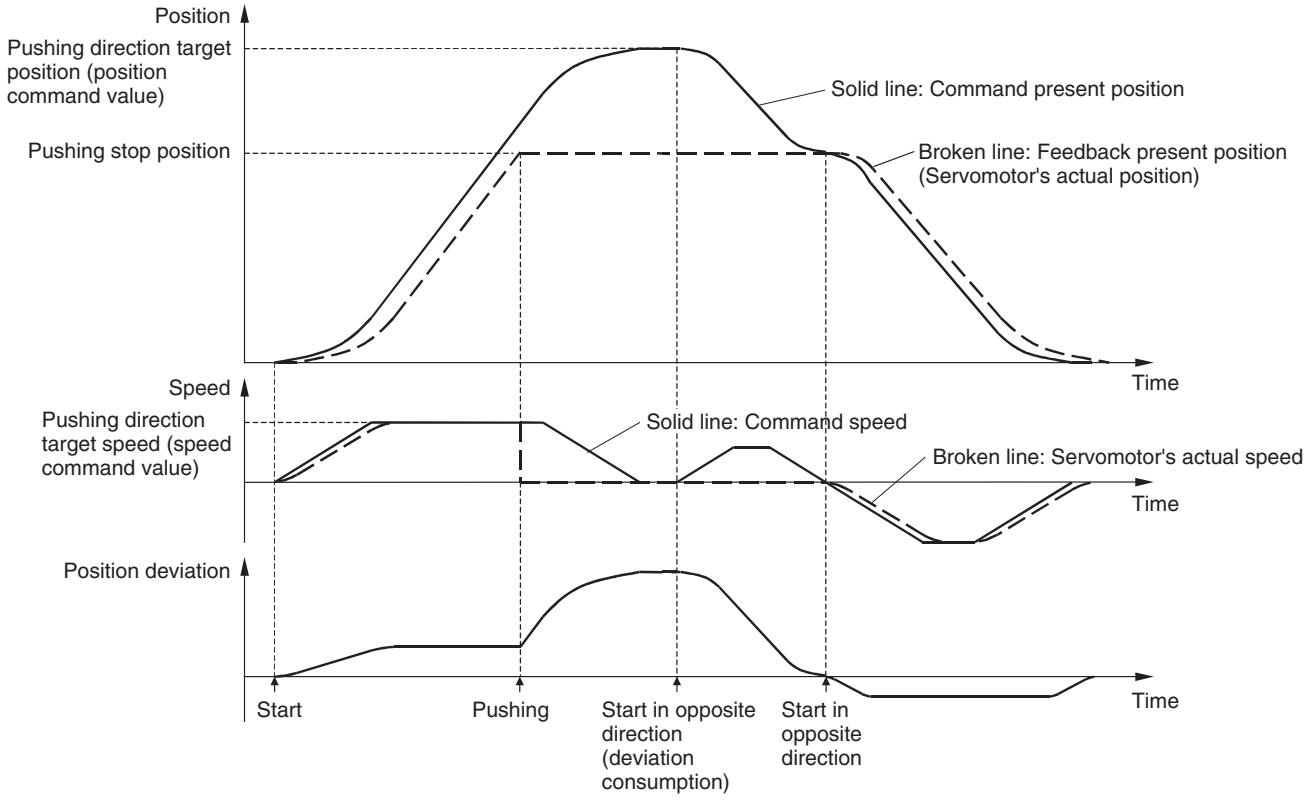
If the Current Limit Designation Bit setting is disabled for the direction in which the load is being pushed when operation is started in the opposite direction (i.e., an operating command is sent without specifying the torque limit), torque will be generated in the pushing direction at the start of operation. This is due to the position deviation accumulated in the pushing direction and may result in damage to the machine or an accident.

When performing an operation to return from the pushing position, the Servomotor will remain stopped for the movement command while the position deviation accumulated due to pushing is distributed. When the difference between the pushing operation target position and pushing stop position is large (the accumulated position deviation is large), the Servomotor will immediately accelerate to the target speed after the accumulated position deviation is distributed.

To prevent this from occurring, set the positioning target position as close to the pushing stop position as possible to minimize the accumulated position deviation during pushing. (See below.)



Alternatively, before performing the return operation, send a movement command to move the axis to the pushing stop position (feedback present position at pushing stop) and distribute the accumulated position deviation beforehand, as shown in the following diagram.



Note The DEVIATION COUNTER RESET can be used to reset the remaining position deviation to 0 for PCUs with unit version 1.3 or later. Refer to *10-10 DEVIATION COUNTER RESET* for details on DEVIATION COUNTER RESET.

10-5 Speed Control

10-5-1 Overview

In Speed control, the PCU controls the rotation speed of the Servomotor by directly executing speed commands in a speed loop without using the Servo Drive's position loop.

Speed control can be used when a W-series Servo Drive is connected.

With the SMARTSTEP Junior Servo Drives, speed commands cannot be given directly for a speed loop. When using a SMARTSTEP Junior Servo Drive, position control can be performed while changing the speed using jogging or direct operation to achieve feeding at desired speeds.

10-5-2 Starting Speed Control

Speed control is performed by setting the target speed in the speed command value for speed control in the Axis Operating Output Memory Areas and started when the SPEED CONTROL Bit turns ON. When starting speed control, make sure that the SPEED CONTROL Bit remains ON until the Receiving Command Flag or Busy Flag in the Axis Operating Input Memory Area turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the SPEED CONTROL command will be ignored. Be sure that all of these command bits are OFF before executing speed control.

The speed command value for speed control is set in units of 0.001% as a ratio of the Servomotor's momentary maximum rotation speed. (The unit is different from that used for the speed command value for position control (command units/s).) The speed command value is specified in the range −199.999% to 199.999%, and the rotation direction is determined by the sign (positive or negative) of the speed command value.

The actual Servomotor speed control range and minimum control unit depend on the Servo Drive specifications.

To stop speed control, execute DECELERATION STOP or EMERGENCY STOP. (For details on stop functions, refer to *10-9 Stop Functions*.)

Servo Parameter Area

G-series Servo Drive Speed Control Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn003	Torque limit selection	---	1 to 5	2	1
---	Pn062	Rotation speed for motor rotation detection	r/min	10 to 20000	2	50
---	Pn061	Speed conformity signal output width	r/min	10 to 20000	2	20

Pn003 is used to select the function of the option command value for speed control.

The option command value for speed control is described on the following pages.

Pn062 is set as the detection threshold of the Zero Speed Flag (word b+1, bit 08) in the Axis Operating Input Memory Area. Pn061 is set as the detection width of the Speed Conformity Flag (word b+1, bit 07) in the Axis Operating Input Memory Area.

W-series Servo Drive Speed Control Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn002.0	Function selection application switch 2 Torque command input change	---	0 to 3	2	0
---	Pn502	Rotation speed for motor rotation detection	r/min	1 to 10000	2	20
---	Pn503	Speed conformity signal output width	r/min	0 to 100	2	10

Pn002.0 is used to select the function of the option command value for speed control. The option command value for speed control is described in the following pages.

The data length for Pn002.0 is the set value specified to transfer Pn002 (including Pn002.0) when transferring Servo Parameters.

Pn502 is set as the detection threshold of the Zero Speed Flag (word b+1, bit 08) in the Axis Operating Input Memory Area. Pn503 is set as the detection width of the Speed Conformity Flag (word b+1, bit 07) in the Axis Operating Input Memory Area.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
DECELERATION STOP	a	15	0 → 1: Starts deceleration stop.
SPEED CONTROL	a+1	02	0 → 1: Starts speed control.
EMERGENCY STOP		15	0 → 1: Starts emergency stop.

Name	Word	Bits	Contents
Speed command value (for speed control)	a+6 a+7	---	Speed command value (rightmost word) Speed command value (leftmost word) Unit: 0.001% (percentage of Servomotor's momentary maximum rotation speed) Command range: −199.999% to 199.999% (FFFCF2C1 to 00030D3F hex) **Note** The rotation direction is determined by the sign.
Option command value 1	a+10 a+11	---	Torque limit/torque feed forward (rightmost word) Torque limit/torque feed forward (leftmost word) Unit: % (percentage of Servomotor's momentary maximum torque) Command range: 0% to 399% (See note.) (00000000 to 0000018F hex) When using G-series Servo Drives, the option command value 1 can be used as the torque limit command value or torque feed forward command value by setting the Servo Parameter *Torque Limit Selection* (Pn003). When using W-series Servo Drives, the option command value 1 can be used as the torque limit command value or torque feed forward command value by setting *Torque Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.0).
Option command value 2	a+12 a+13	---	Torque limit (rightmost word) Torque limit (leftmost word) Unit: % (percentage of Servomotor's momentary maximum torque) Command range: 0 to 399% (See note.) (00000000 to 0000018F hex) When using G-series Servo Drives, the option command value 2 can be used as the torque limit command value or torque feed forward command value by setting the Servo Parameter *Torque Limit Selection* (Pn003). When using W-series Servo Drives, the option command value 2 can be used as the torque limit command value by setting *Torque Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.0).
Forward rotation current limit designation	a+16	14	1: Use forward torque limit.
Reverse rotation current limit designation		15	1: Use reverse torque limit.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. − 1) × 25

Note The torque limit for option command values during speed control can be specified between 0 and 399 for the PCU, but the effective command value depends on Servo Drive specifications. The following command range restrictions are for W-series Servo Drives.

R88D-WT□ + JUSP-NS115

Command range: 0% to 199% (00000000 to 000000C7 hex)
Torque limits will not be set correctly for command values between 200% ad 399%. Use values between 0% and 199%.

R88D-WN□-ML2 (built-in MECHATROLINK-II Communications)

Command range: 0% to 199% (00000000 to 000000C7 hex)
Torque limits will not be set correctly for command values between 200% ad 399%. Use values between 0% and 199%.

A command range check (0 to 399) is performed for the option command value for speed control when the speed control command is given. If the option command value is out of range, an option command value error (error code: 3064 or 3065) will occur. The command range check will be performed even if the Speed Command Input Change parameter in the Function Selection Application Switches 2 is set to disable using the option command value. Always set the option command value to 0 when it is not being used.

Note The same option command value parameter is used for both speed and torque control. The allowable setting ranges for speed and torque control, however, are different. When switching between speed and torque control, be sure that the option command value is set within the proper range for the current type of control.

Changes to the speed command value for speed control during operation are always effective. During speed control, by setting a new speed command value for speed control in the Axis Operating Output Memory Area, the target speed for speed control can be changed.

The settings for option command values 1 and 2 (torque limit/torque feed forward command values) and Forward/Reverse Rotation Current Limit Designation Bits are enabled when the SPEED CONTROL Bit turns ON. Changing these command values while speed control is being executed and then turning ON the SPEED CONTROL Bit again enables the option command values and Current Limit Designation Bits to be changed during operation.

It is necessary to pay attention to the change of output torque when switching from the speed control mode to the position control mode with deceleration stop. For details, refer to *10-5-3 Switching Control Mode*.

Note When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).
Speed Conformity Flag	b+1	07	1: Speed matches the speed command value for speed control.
Zero Speed Flag		08	1: Detecting zero speed.
Torque Limit Status Flag		09	1: Torque limit in progress.
Feedback present position	b+6 b+7	---	Present position Feedback position (rightmost word) Feedback position (leftmost word)
Command present position	b+8 b+9	---	Present position Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start speed control is received by the PCU. Use the Receiving Command Flag when starting and changing option commands to control the ON/OFF timing for SPEED CONTROL.

During speed control, bits 07 and 08 in the Servo Status Flags (word b+1) of the Axis Operating Input Memory Area function as the Speed Conformity Flag and Zero Speed Flag respectively.

The command present position that is output during speed control is calculated from the feedback position and the position deviation that is inferred from the current speed.

Acceleration and Deceleration during Speed Control

When SPEED CONTROL is executed, the Servo Drive performs stepped speed control from the present feedback speed to the target speed specified in the speed command value for speed control. Apart from smoothly increasing/decreasing the speed command value (for speed control) when starting speed control, shock in acceleration/deceleration when performing speed control can also be minimized by setting the Servo Parameters *Soft Start Acceleration Time* and *Soft Start Deceleration Time* to create a trapezoidal speed curve.

G-series Acceleration/Deceleration Constants for Speed Control

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn058	Soft start acceleration time	2 ms	0 to 5000	2	0
---	Pn059	Soft start deceleration time	2 ms	0 to 5000	2	0

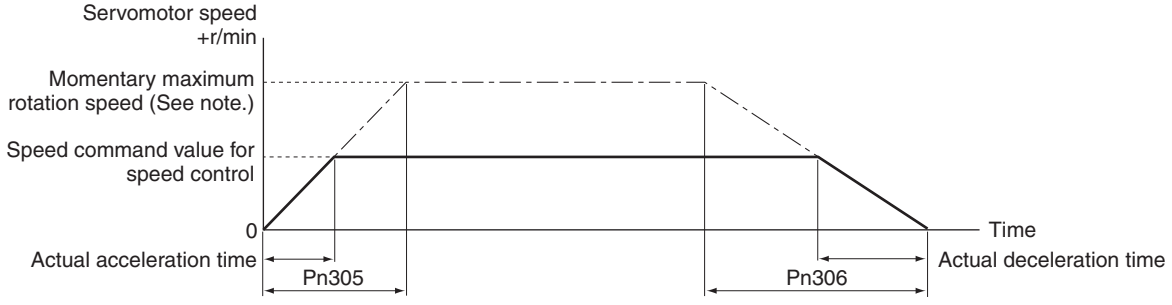
W-series Acceleration/Deceleration Constants for Speed Control

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn305	Soft start acceleration time	ms	0 to 10000	2	0
---	Pn306	Soft start deceleration time	ms	0 to 10000	2	0

The *Soft Start Acceleration Time* and *Soft Start Deceleration Time* are set respectively as the acceleration time and deceleration time between speed 0 (speed command value for speed control: 0%) and the momentary maximum rotation speed of the Servomotor (speed command value for speed control: 100%).

The acceleration time and deceleration time for the actual target speed are as follows:

$$\text{Actual acceleration (deceleration) time} = \frac{\text{Speed command value for speed control (r/min)}}{\text{Momentary maximum rotation speed (r/min)}} \times \text{Soft start acceleration (deceleration) time}$$



Note The momentary maximum rotation speed depends on the Servomotor used. Refer to the momentary maximum rotation speed for the Servomotor used. The following values apply to W-series Servomotors.

3,000-r/min Servomotor (cylinder type or flat type): 5,000 r/min
1,000-r/min Servomotor: 2,000 r/min
1,500-r/min Servomotor (450 W to 7.5 kW): 3,000 r/min
1,500-r/min Servomotor (11 to 15 kW): 2,000 r/min

Option Command Value during Speed Control

When speed control is used, the torque limit and torque feed forward functions can be applied during speed control by setting Servo Parameter *Torque Limit Selection* (Pn003) when using G-series Servo Drives or Servo Parameter *Torque Command Input Change* of *Function Selection Application Switch 2* (Pn002.0) when using W-series Servo Drives and setting the Current Limit Designation Bits and option command values in the Axis Operating Output Memory Area.

When using G-series Servo Drives, the torque limit/torque feed forward function depends on the Servo Parameter and output bit combinations, as follows:

Torque Limit Selection (Pn003)	PCL	NCL	R88D-GN□-ML2 (with built-in MECHATROLINK-II communications)
1	---	---	Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and the torque feed forward function is enabled. Pn05E functions as a forward torque limit value/reverse torque limit value and the torque limit function is enabled.
2	---	---	Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and the torque feed forward function is enabled. Pn05E functions as a forward torque limit value, Pn05F functions as a reverse torque limit value and the torque limit function is enabled.
3	---	---	Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and the torque feed forward function is enabled.
	OFF	OFF	Pn05E functions as a forward torque limit value/reverse torque limit value and the torque limit function is enabled.
	OFF	ON	Pn05E functions as a forward torque limit value, Pn05F functions as a reverse torque limit value and the torque limit function is enabled.
	ON	OFF	Pn05F functions as a forward torque limit value, Pn05E functions as a reverse torque limit value and the torque limit function is enabled.
	ON	ON	Pn05F functions as a forward torque limit value/reverse torque limit value and the torque limit function is enabled.
4	---	---	The torque feed forward function is disabled. Whichever is smaller of the Servo Parameter Pn05E and option command value 1 (word a+10, a+11) functions as a forward torque limit value, whichever is smaller of the Servo Parameter Pn05F and option command 2 (word a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.

Torque Limit Selection (Pn003)	PCL	NCL	R88D-GN□-ML2 (with built-in MECHATROLINK-II communications)
5	---	---	The torque feed forward function is disabled.
	OFF	OFF	Pn05E functions as a forward torque limit value and the torque limit function is enabled. Pn05F functions as a reverse torque limit value and the torque limit function is enabled.
	OFF	ON	Pn05E functions as a forward torque limit value and the torque limit function is enabled. Whichever is smaller of the Servo Parameter Pn05F and option command value 2 (word a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.
	ON	OFF	Whichever is smaller of the Servo Parameter Pn05E and option command value 1 (word a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled. Pn05F functions as a reverse torque limit value and the torque limit function is enabled.
	ON	ON	Whichever is smaller of the Servo Parameter Pn05E and option command value 1 (word a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled. Whichever is smaller of the Servo Parameter Pn05F and option command value 2 (word a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.

Note PCL ON: When either the Forward Torque Limit (CN1 PCL: Pin 7) or Forward Rotation Current Limit Designation (word a+1614) is turned ON.

NCL ON: When either the Reverse Torque Limit (CN1 NCL: Pin 8) or Reverse Rotation Current Limit Designation (word a+1615) is turned ON.

When an R88D-WT□ W-series Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module or an R88D-WN□-ML2 W-series Servo Drive with built-in MECHATROLINK-II communications is connected to the PCU, the torque limit/torque feed forward function depends on the Servo Parameter and output bit combinations, as follows:

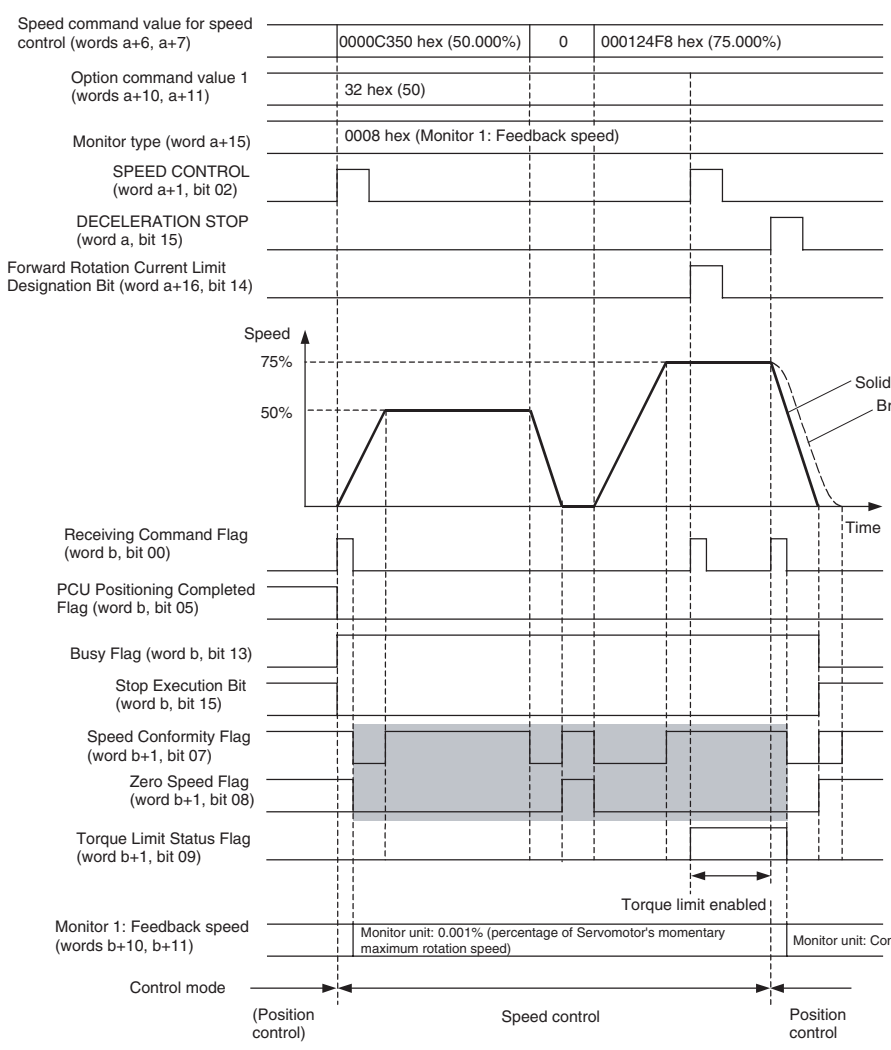
Torque command input change (Pn002.0)	Forward rotation current limit designation (word a+16, bit 14	Reverse rotation current limit designation (word a+16, bit 15)	R88D-WT□ + JUSP-NS115	R88D-WN□-ML2 with built-in MECHATROLINK-II communications
0	---	---	Option command values 1 and 2 are disabled. Use set value 0.	Option command values 1 and 2 are disabled. Use set value 0.
1	---	---	Option command value 1 (words a+10, a+11) functions as a torque limit value and the torque limit function is enabled in both directions.	Option command value 1 (words a+10, a+11) functions as a forward torque limit value, option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.
2	---	---	Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and torque feed forward is enabled.	Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and torque feed forward is enabled.

Torque command input change (Pn002.0)	Forward rotation current limit designation (word a+16, bit 14	Reverse rotation current limit designation (word a+16, bit 15)	R88D-WT□ + JUSP-NS115	R88D-WN□-ML2 with built-in MECHATROLINK-II communications
3	0	0	Option command values 1 and 2 are disabled. Use set value 0.	Option command values 1 and 2 are disabled. Use set value 0.
	0	1	Option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.	Option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.
	1	0	Option command value 1 (words a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled.	Option command value 1 (words a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled.
	1	1	Option command value 1 (words a+10, a+11) functions as a torque limit value and the torque limit function is enabled in both directions.	Option command value 1 (words a+10, a+11) functions as a forward torque limit value, option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled.

The settings for option command values 1 and 2 (torque limit/torque feed forward command values) and Forward/Reverse Rotation Current Limit Designation Bits are enabled when the SPEED CONTROL Bit turns ON. Changing these command values while speed control is being executed and then turning ON the SPEED CONTROL Bit again enables the option command values and Current Limit Designation Bits to be changed during operation.

The torque limit for speed control set in the option command values can be used together with the torque limit function (refer to *10-4 Torque Limits*). When enabling multiple torque limit functions simultaneously, the Servomotor's output torque is limited by the minimum torque limit setting.

Example Timing Chart for W-series Speed Control


Speed command value for speed control (words a+6, a+7)
0000C350 hex (50.000%)
0
000124F8 hex (75.000%)
Option command value 1 (words a+10, a+11)
32 hex (50)
Monitor type (word a+15)
0008 hex (Monitor 1: Feedback speed)
SPEED CONTROL (word a+1, bit 02)
DECELERATION STOP (word a, bit 15)
Forward Rotation Current Limit Designation Bit (word a+16, bit 14)
Speed
75%
50%
Time
Solid line: Command speed
Broken line: Feedback speed
Receiving Command Flag (word b, bit 00)
PCU Positioning Completed Flag (word b, bit 05)
Busy Flag (word b, bit 13)
Stop Execution Bit (word b, bit 15)
Speed Conformity Flag (word b+1, bit 07)
Zero Speed Flag (word b+1, bit 08)
Torque Limit Status Flag (word b+1, bit 09)
Torque limit enabled
Monitor 1: Feedback speed (words b+10, b+11)
Monitor unit: 0.001% (percentage of Servomotor's momentary maximum rotation speed)
Monitor unit: Command units/s
Control mode
(Position control)
Speed control
Position control

The target speed can be changed at any time during speed control by overwriting the speed command value.

The torque limit operation can be switched between enabled and disabled status during operation by changing the option command value and Current Limit Designation Bit settings during speed control, and executing SPEED CONTROL.
The function combination depends on the setting in Pn002.0 (torque command input change).
Axes operating with speed control are stopped using DECELERATION STOP or EMERGENCY STOP.
In this example, the Servo Parameter Pn002.0 (torque command input change) is set to 3: Current Limit Designation Bit are used.

The acceleration/deceleration during speed control depends on the setting in the Servo Parameter *Soft Start Acceleration/Deceleration Time*, and the deceleration for deceleration stop depends on the settings in the Servo Parameters related to acceleration/deceleration.

The Receiving Command Flag turns ON for at least one cycle time when the movement command is received.

Bits 07 and 08 in the Servo Status Flags (word b+1) function, respectively, as the Speed Conformity Flag and Zero Speed Flag from the time when SPEED CONTROL is received (when the Receiving Command Flag turns OFF) until the command to switch to position control, such as DECELERATION STOP, is received (when the Receiving Command Flag turns OFF), as indicated by the shaded area.
The Torque Limit Status Flag is ON when the torque limit function is enabled and operating. This flag does not turn ON if the output torque reaches the limit value or lower during Servomotor rotation and thus the torque limit function is not ON.

When the speed (feedback speed, command speed, or target speed) is selected for monitor 1 or 2, the monitoring unit for position control/torque control, and speed control will change. The speed command value for speed control (unit: 0.001%) is used from when the speed control command is received (when the Receiving Command Flag turns OFF) and the speed command value for position control (command units/s) is used from when the command to switch to position control or torque control is received.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Status and Monitoring during Speed Control

When SPEED CONTROL is executed, some of the Status Flags, monitoring functions, and display units change.

Servo Status Flags in Axis Operating Input Memory Area (Word b+1)

The functions of bits 07 and 08 in the Servo Status Flags of the Axis Operating Input Memory Area change depending on whether position control or speed control is used.

Word	Bits	Control mode	Flag name	Function	Function change timing
b+1	07	Position control	Positioning Completed (PSET) Flag	Sending the position control command to the Servo Drive completed and the position is within *Positioning Completion Range 1* (in position).	The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF).
		Speed control	Speed Conformity (V-CMP) Flag	Speed matches the speed command value for speed control.	The function changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF).
	08	Position control	Distribution Completed (DEN) Flag	Sending the position control command to the Servo Drive completed (operating for the number of pulses remaining in the deviation counter).	The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF).
		Speed control	Zero Speed (ZSPD) Flag	Speed control with zero speed in progress.	The function changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF).

Monitors 1 and 2 in Axis Operating Input Memory Areas

When the speed (feedback speed, command speed, or target speed) is selected for monitor 1 or 2, the monitoring unit for position control/torque control, and speed control will change, as follows:

Control mode	Speed monitoring unit	Unit change timing
Position control/Torque control	Command units/s	The unit changes when the command to switch to position control/torque control has been received (when the Receiving Command Flag turns OFF).
Speed control	0.001% (percentage of Servomotor's momentary maximum rotation speed)	The unit changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF).

10-5-3 Switching Control Mode

The PCU's operating commands can be used to switch between position control, speed control, and torque control of active axes, as follows:

Operating command	Control mode	Operation when operating command is executed
ABSOLUTE MOVEMENT	Position control	Switches to position control from any control mode when the command starts and executes positioning with an absolute position.
RELATIVE MOVEMENT	Position control	Switches to position control from any control mode when the command starts and executes positioning with a relative position.
ORIGIN SEARCH	Position control	A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode.
ORIGIN RETURN	Position control	A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode.

Operating command	Control mode	Operation when operating command is executed
JOG	Position control	A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode.
DECELERATION STOP	Position control	Switches to position control when the command starts from any control mode, and deceleration stop is executed.
SPEED CONTROL	Speed control	Switches to speed control when the command starts from any control mode.
TORQUE CONTROL	Torque control	Switches to torque control when the command starts from any control mode.
EMERGENCY STOP	Position control	Switches to position control when the command starts from any control mode, and emergency stop is executed.
SERVO UNLOCK	Position control	When executing SERVO UNLOCK, the PCU executes DECELERATION STOP for the Servo Drive, followed immediately (without waiting for the axis to stop) by SERVO UNLOCK. When SERVO UNLOCK is executed during speed control or torque control, the Servo Drive will recover in the position control mode's Servo lock status the next time the SERVO LOCK command is executed.
DEVICE SETUP	Position control	Switches to position control when the command starts, and recovers in position control mode when SERVO LOCK is executed.

If operation stops due to an error (except stopping that puts Servo in free run state), the Servomotor stops in position control mode (deceleration stop or emergency stop) and remains in position control mode (Servo lock status) after stopping. After turning ON the power to the PCU or restarting the Unit and executing CONNECT or SERVO LOCK, the PCU will be put in the position control mode and in Servo lock status.

Note When SERVO UNLOCK is executed during speed control or torque control, the Servo Drive will recover in the position control mode and in Servo lock status the next time the SERVO LOCK command is executed. If MECHATROLINK communications are stopped (connection released) or the power to the PCU is interrupted during speed control or torque control, the Servo Drive will be put in Servo free run state in the previous control mode. While in this state, if MECHATROLINK communications are started (connection established) and SERVO LOCK is executed, the Servomotor starts operating immediately in the previous command state. The speed monitor and torque monitor in the PCU's expanded monitoring functions will also not function properly. To stop MECHATROLINK communications while in speed control or torque control mode, use DECELERATION STOP or another command that will switch the Servo Drive to position control, and execute the next SERVO LOCK command in position control mode. If the Servo is in a free run state during speed control or torque control (due to an error or other cause), execute DEVICE SETUP before the next SERVO LOCK and switch the Servo Drive to position control mode.

When switching to position control from speed control or torque control, the feedback speed for executing operating commands in position control is used as the start speed. Movement to the position control target speed or stop operation is then performed using the acceleration/deceleration set in the Servo Parameters for acceleration/deceleration.

Changes in Torque when Switching Control Modes

When switching to another control mode during torque control, position control with the torque limit enabled, or speed control, the torque in the control mode to be switched to must be considered. For example, if DECELERATION STOP is executed with the torque limit disabled during speed control with the torque limit enabled, position control will be used without the output torque limit during the time deceleration stop is executed.

When switching from the control mode that requires a constant torque limit, such as for pushing or pulling a load, make sure that the torque limit is also enabled for the next operating command to be executed to prevent a sudden change in output torque.

Note In speed control mode, axis stop operations due to errors are executed after switching to position control. The torque limit for these stop operations depends on the setting of the Current Limit Designation Bit at when the error occurred. When executing speed control with the torque limit enabled using the option command value, if the Current Limit Designation Bit is not set to ON, the axis stop operation due to error will be executed with the torque limit disabled. To enable the torque limit for axis stop operations due to errors, turn ON the Current Limit Designation Bit and set Servo Parameters *No.1 Torque Limit* (Pn05E) or *No.2 Torque Limit* (Pn05F) when using G-series Servo Drives, and *Forward Rotation External Current Limit* (Pn404) or *Reverse Rotation External Current Limit* (Pn405) when using W-series Servo Drives.

10-6 Torque Control

10-6-1 Overview

In torque control, the PCU controls the output torque of the Servomotor by directly executing torque commands in a torque (current) loop without using the Servo Drive's position loop or speed loop.

Torque control can be used when a G-series Servo Drive or a W-series Servo Drive is connected. The SMARTSTEP Junior Servo Drives do not support torque control.

10-6-2 Starting Torque Control

Torque control is performed according to the target torque set in the torque command value in the Axis Operating Output Memory Areas and started when the TORQUE CONTROL Bit turns ON. When starting torque control, make sure that the TORQUE CONTROL Bit remains ON until the Receiving Command Flag or Busy Flag in the Axis Operating Input Memory Area turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the TORQUE CONTROL command will be ignored. Be sure that all of these command bits are OFF before executing torque control.

The torque command value is set in units of 0.001% as a percentage of the Servomotor's momentary maximum torque. The torque command value is specified in the range −199.999% to 199.999%, and the rotation direction is determined by the sign (positive or negative) of the torque command value. The actual Servomotor torque control range and minimum control unit depend on the Servo Drive specifications.

To stop torque control, execute DECELERATION STOP or EMERGENCY STOP. (For details on stop functions, refer to *10-9 Stop Functions*.)

Servo Parameter Area **G-series Torque Control Parameters**

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn05B	Speed limit selection	---	0, 1	2	0
---	Pn053	Speed limit	r/min	–20000 to 20000	2	50

Pn05B is used to select the function of the option command value for torque control.

The option command value for torque control is described in the following pages.

Pn053 is used to set the fixed speed limit for torque control.

W-series Torque Control Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn002.1	Function selection application switch 2 Speed command input switching	---	0, 1	2	0
---	Pn407	Speed limit	r/min	0 to 10000	2	3000

Note The default settings correspond to those used for W-series Servo Drives.

Pn002.1 is used to select the function of the option command value for torque control. The option command value for torque control is described in the following pages.

The data length for Pn002.1 is the set value specified to transfer Pn002 (including Pn002.1) when transferring Servo Parameters. Pn407 is used to set the fixed speed limit for torque control.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
DECELERATION STOP	a	15	0 → 1: Starts deceleration stop.
TORQUE CONTROL	a+1	03	0 → 1: Starts torque control.
EMERGENCY STOP		15	0 → 1: Starts emergency stop.
Torque command value	a+8 a+9	---	Torque command value (rightmost word) Torque command value (leftmost word) Unit: 0.001% (percentage of Servomotor's momentary maximum torque) Command range: –199.999 to 199.999% (FFFCF2C1 hex to 00030D3F hex) **Note** The rotation direction is determined by the sign.
Option command value 1	a+10 a+11	---	Speed limit value (rightmost word) Speed limit value (leftmost word) Unit: 0.001% (percentage of Servomotor's momentary maximum rotation speed) Command range: 0 to 100.000% (See note 1.) (00000000 hex to 000186A0 hex) The option command value 1 can be used as the speed limit value during torque control by setting the Servo Parameter *Speed Limit Selection* (Pn05B) when using G-series Servo Drives, and the *Speed Command Input Change* in Servo Parameter *Function Selection Application Switch 1* (Pn002.1) when using W-series Servo Drives.
Forward rotation current limit designation	a+16	14	1: Use forward torque limit.
Reverse rotation current limit designation		15	1: Use reverse torque limit.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Note

(1) A command range check (0 to 10,000) is performed for the option command value for torque control when the torque control command is given. If the option command value is out of range, an option command value error (error code: 3064) will occur. The command range check will be performed even if the Servo Parameter Speed *Limit Selection* (Pn05B) when using G-series Servo Drives, or the Torque Command Input Change parameter in the Function Selection Application Switches 2 when using W-series Servo Drives is set to disable using the option command value. Always set the option command value to 0 when it is not being used.

(2) The same option command value parameter is used for both speed and torque control. The allowable setting ranges for speed and torque control, however, are different. When switching between speed and torque control, be sure that the option command value is set within the proper range for the current type of control.

Changes to the torque command value during operation are always effective. during torque control, by setting a new torque command value in the Axis Operating Output Memory Area, the target torque for torque control can be changed.

The data for option command value 1 (speed limit value) is enabled when the start bit for TORQUE CONTROL turns ON. Changing these set values while torque control is being executed and then turning ON the TORQUE CONTROL Bit again enables the speed limit value to be changed during operation.

The torque limit can also be applied by turning ON the Forward/Reverse Rotation Current Limit Designation Bit when executing TORQUE CONTROL. (For details, refer to *10-4-3 Torque Limits Set by Operating Commands*.)

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Error Flag		12	0: No axis error. 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).
Torque Limit Status Flag	b+1	09	1: Torque limit in progress.
Speed Limit Status Flag		11	1: Speed limit in progress.
Feedback present position	b+6 b+7	---	Present position Feedback position (rightmost word) Feedback position (leftmost word)
Command present position	b+8 b+9	---	Present position Command position (rightmost word) Command position (leftmost word)

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start torque control is received by the PCU. Use the Receiving Command Flag when starting and changing option commands to control the ON/OFF timing for TORQUE CONTROL.

During torque control, bit 11 in the Servo Status Flags (word b+1) of the Axis Operating Input Memory Area functions as the Speed Limit Status Flag.

The command present position that is output during torque control is calculated from the feedback position and the position deviation that is inferred from the current speed.

Changes in output torque may affect operation when switching to speed control or position control with deceleration stop, while torque control is being performed. For details, refer to *10-5-3 Switching Control Mode*.

Note When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

Option Command Value during Torque Control

A speed limit can be applied during torque control by setting Servo Parameter *Speed Limit Selection* (Pn05B) when using G-series Servo Drives, and the *Speed Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.1) when using W-series Servo Drives and the option command value.

The speed limit functions depend on the Servo Parameter and output bit combinations, as follows:

G-series Servo Drives

Speed command input change (Pn05B)	Function
0	Option command values 1 and 2 are disabled. Use set value 0.
1	Limits speed during torque control, using option command value 1 (words a+10, a+11) as the speed limit value. Option command value 2 is not used. Use set value 0.

W-series Servo Drives

Speed command input change (Pn002.1)	Function
0	Option command values 1 and 2 are disabled. Use set value 0.
1	Limits speed during torque control, using option command value 1 (words a+10, a+11) as the speed limit value. Option command value 2 is not used. Use set value 0.

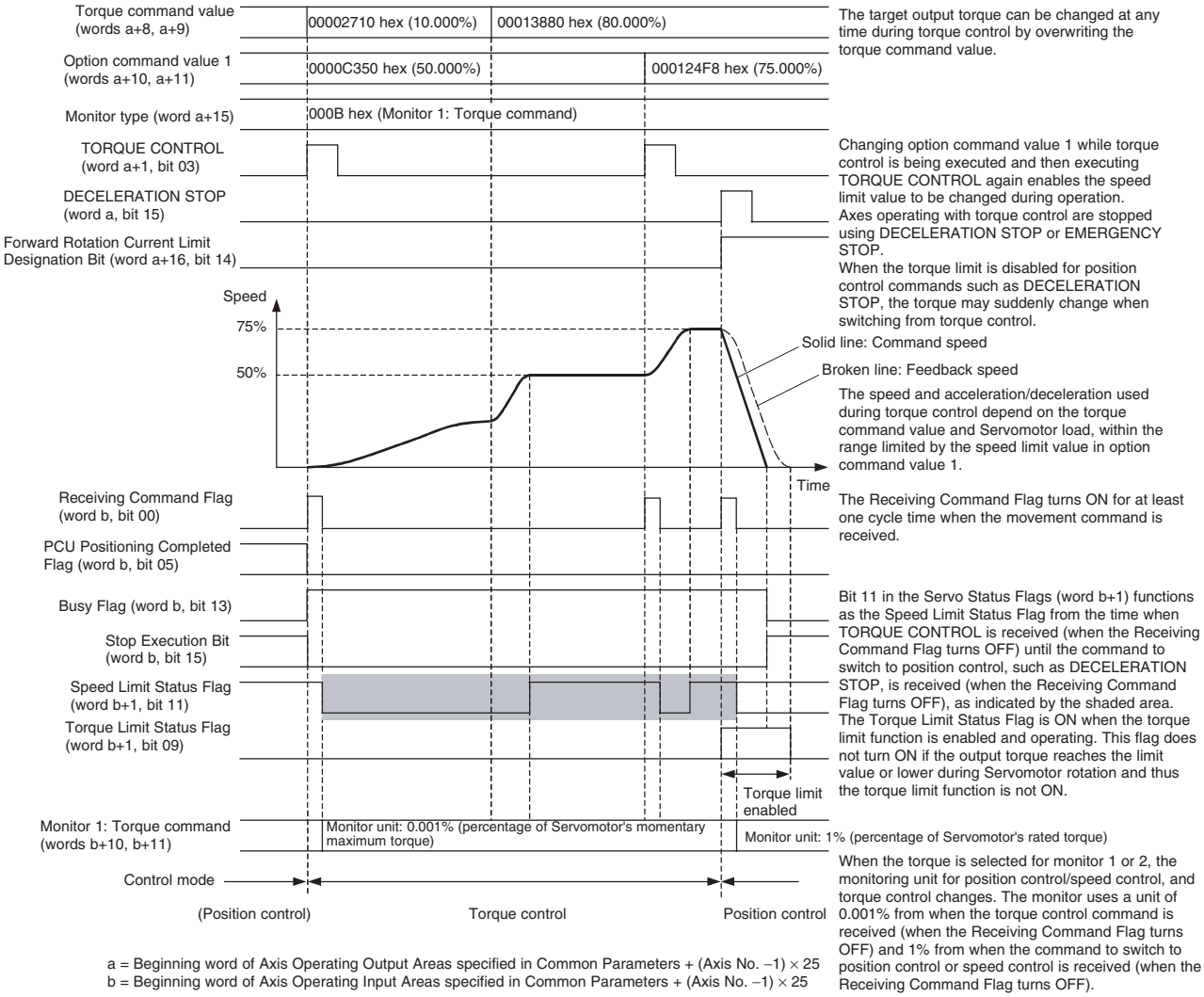
The data for option command value 1 (speed limit value) is enabled when the bit for TORQUE CONTROL turns ON. Changing option command value 1 while torque control is being executed and then turning ON the TORQUE CONTROL Bit again enables the speed limit value to be changed during operation.

The speed limit for torque control set in the option command value can be used together with a Servo Parameter (Pn053 for the G Series and Pn407 for the W Series) (speed limit). When both speed limit functions are enabled at the same time, the Servomotor's rotation speed is limited by the lowest speed limit setting.

Note The speed limit functions for torque control are used to limit the Servomotor's rotation speed in a steady state, and not the upper limit (maximum value) of the Servomotor's rotation speed. Transitional overshooting may occur in the Servomotor's rotation speed and the speed limit value may be exceeded due

to conditions such as the torque command value, Servomotor load, and inertia.

Example Timing Chart for Torque Control


Torque command value (words a+8, a+9)
00002710 hex (10.000%)
00013880 hex (80.000%)
The target output torque can be changed at any time during torque control by overwriting the torque command value.
Option command value 1 (words a+10, a+11)
0000C350 hex (50.000%)
000124F8 hex (75.000%)
Monitor type (word a+15)
000B hex (Monitor 1: Torque command)
TORQUE CONTROL (word a+1, bit 03)
DECELERATION STOP (word a, bit 15)
Forward Rotation Current Limit Designation Bit (word a+16, bit 14)
Changing option command value 1 while torque control is being executed and then executing TORQUE CONTROL again enables the speed limit value to be changed during operation.
Axes operating with torque control are stopped using DECELERATION STOP or EMERGENCY STOP.
When the torque limit is disabled for position control commands such as DECELERATION STOP, the torque may suddenly change when switching from torque control.
Speed
75%
50%
Solid line: Command speed
Broken line: Feedback speed
The speed and acceleration/deceleration used during torque control depend on the torque command value and Servomotor load, within the range limited by the speed limit value in option command value 1.
Time
Receiving Command Flag (word b, bit 00)
The Receiving Command Flag turns ON for at least one cycle time when the movement command is received.
PCU Positioning Completed Flag (word b, bit 05)
Busy Flag (word b, bit 13)
Stop Execution Bit (word b, bit 15)
Speed Limit Status Flag (word b+1, bit 11)
Torque Limit Status Flag (word b+1, bit 09)
Bit 11 in the Servo Status Flags (word b+1) functions as the Speed Limit Status Flag from the time when TORQUE CONTROL is received (when the Receiving Command Flag turns OFF) until the command to switch to position control, such as DECELERATION STOP, is received (when the Receiving Command Flag turns OFF), as indicated by the shaded area.
The Torque Limit Status Flag is ON when the torque limit function is enabled and operating. This flag does not turn ON if the output torque reaches the limit value or lower during Servomotor rotation and thus the torque limit function is not ON.
Torque limit enabled
Monitor 1: Torque command (words b+10, b+11)
Monitor unit: 0.001% (percentage of Servomotor's momentary maximum torque)
Monitor unit: 1% (percentage of Servomotor's rated torque)
When the torque is selected for monitor 1 or 2, the monitoring unit for position control/speed control, and torque control changes. The monitor uses a unit of 0.001% from when the torque control command is received (when the Receiving Command Flag turns OFF) and 1% from when the command to switch to position control or speed control is received (when the Receiving Command Flag turns OFF).
Control mode
(Position control)
Torque control
Position control

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

For details on switching to torque control from position control or speed control, refer to *10-5-3 Switching Control Mode*.

Note (1) When SERVO UNLOCK is executed during speed control or torque control, the Servo Drive will recover in the position control mode and in Servo lock status the next time SERVO LOCK is executed. If MECHATROLINK communications are stopped (connection released) or the power to the PCU is interrupted during speed control or torque control, the Servo Drive will be put in Servo free run state in the previous control mode. While in this state, if MECHATROLINK communications are started (connection established) and SERVO LOCK is executed, the Servomotor starts operating immediately in the previous command state. The speed monitor and torque monitor in the PCU's expanded monitoring functions will also not function properly. To stop MECHATROLINK communications while in speed control or torque control mode, use DECELERATION STOP or other command that will switch the Servo Drive to position control, and execute the next SERVO LOCK in position control mode. If the Servo is in a free run state during speed control or torque control (due to an error

or other cause), execute DEVICE SETUP before the next SERVO LOCK and switch the Servo Drive to position control mode.

(2) In torque control mode, axis stop operations due to errors are executed after switching to position control. The output torque for these stop operations depends on the setting for error operation in the Current Limit Designation Bit. during torque control execution, if the Current Limit Designation Bit is not set to ON, the axis stop operation due to error will be executed with the torque limit disabled. To enable the torque limit for axis stop operations due to errors, turn ON the Current Limit Designation Bit while torque control is being executed and set Servo Parameters *No.2 Torque Limit* (Pn05F) when using G-series Servo Drives, and *Forward Rotation External Current Limit* (Pn404) or *Reverse Rotation External Current Limit* (Pn405) when using W-series Servo Drives.

Status and Monitoring during Torque Control

When TORQUE CONTROL is executed, some of the Status Flags, monitoring functions, and display units change.

Servo Status Flags in Axis Operating Input Memory Area (Word b+1)

The function of bit 11 in the Servo Status Flags of the Axis Operating Input Memory Area depends on whether position control or torque control is used.

Word	Bits	Control mode	Flag name	Function	Function change timing
b+1	11	Position control	Positioning Proximity (NEAR) Flag	ON when within *Positioning Completion Range 2*	The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF).
		Torque control	Speed Limit (V_LIM) Status Flag	ON when speed limit in progress using speed limit value specified in option command value 1.	The function changes when TORQUE CONTROL has been received (when the Receiving Command Flag turns OFF).

Monitors 1 and 2 in Axis Operating Input Memory Areas

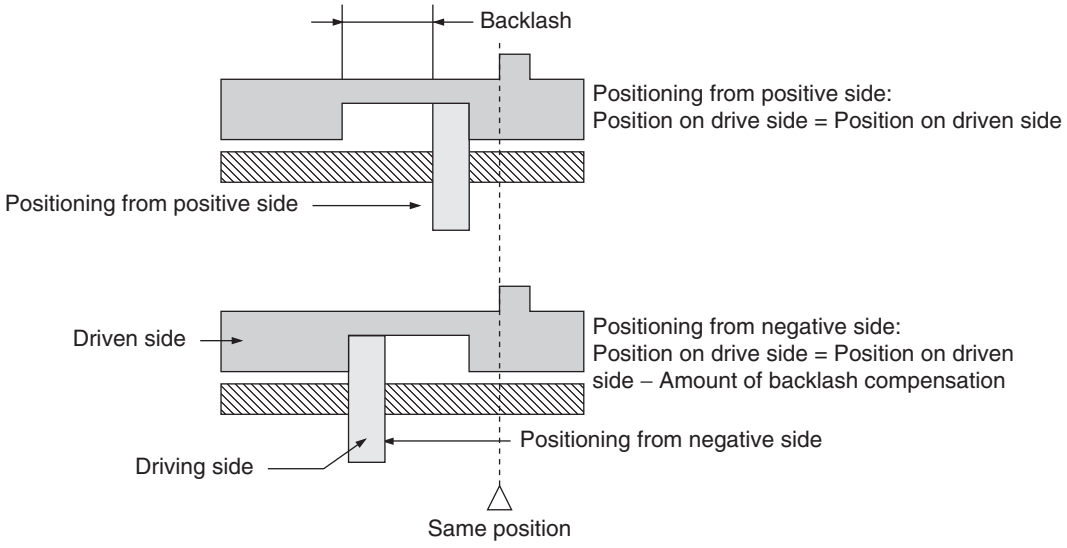
When the torque is selected for monitor 1 or 2, the monitoring unit for position control/speed control, and torque control changes, as follows:

Control mode	Speed monitoring unit	Unit change timing
Position control/speed control	% (1% unit) (percentage of Servomotor's rated torque)	The unit changes when the command to switch to position control or speed control has been received (when the Receiving Command Flag turns OFF).
Torque control	0.001% (percentage of Servomotor's momentary maximum torque)	The unit changes when TORQUE CONTROL has been received (when the Receiving Command Flag turns OFF).

10-7 Backlash Compensation

10-7-1 Overview

"Backlash" is the play between the driving axis and the mechanical system being driven. If there is backlash in positioning from the positive or negative direction, it will cause a discrepancy of the same extent in the positioning. When using a G-series Servo Drive or a W-series Servo Drive, backlash compensation can be used to make this discrepancy as small as possible.


Backlash
Positioning from positive side:
Position on drive side = Position on driven side
Positioning from positive side
Driven side
Positioning from negative side:
Position on drive side = Position on driven side − Amount of backlash compensation
Positioning from negative side
Driving side
Same position

In the above diagram, after positioning from the positive side, backlash is compensated for up to the amount of the output of pulses set for the backlash compensation either when positioning in the negative direction or when the positioning direction is reversed.

The SMARTSTEP Junior Servo Drives do not support backlash compensation.

10-7-2 Backlash Compensation Procedure

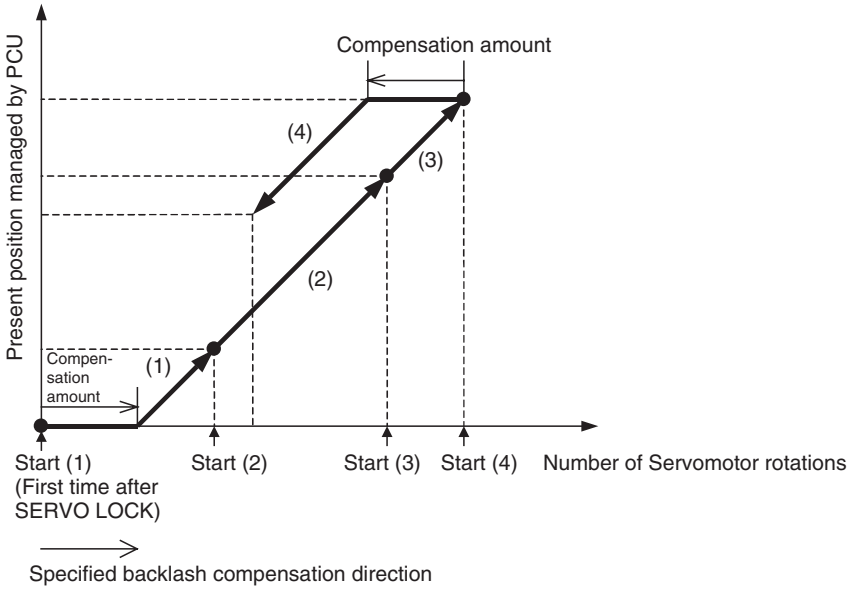
The PCU uses the Servo Drive's backlash compensation function. The Servo Parameters for backlash compensation must be set to enable the backlash compensation function. After setting the Servo Parameters, execute SERVO LOCK, and then perform backlash compensation with the following position control operations.

ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, and JOG

Backlash compensation is disabled when executing SPEED CONTROL or TORQUE CONTROL. Backlash compensation operation functions as follows:

- After SERVO LOCK (First Position Control Operating Command)
  Compensation is applied to the first operating command that operates in the specified backlash compensation direction. Compensation is not applied to operations prior to this that moved axes in the opposite direction to backlash.

- After Backlash Compensation
  Backlash compensation is applied for the first operating command that operates in the opposite direction from which backlash compensation was previously applied. Once backlash compensation has been applied, it will not be applied again as long as operation is continued in the same direction.



Note The PCU's present position compensation according to the backlash compensation function is applied to both the feedback present position and command present position.

10-7-3 Backlash Compensation Data Settings

When a G-series Servo Drive or a W-series Servo Drive is connected, the data settings for backlash compensation are as follows:

Servo Parameter Area **Backlash Compensation Parameters (R88D-GN□-ML2)**

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn100	Backlash compensation selection	---	0 to 2	2	0
---	Pn101	Backlash compensation	Command unit	–32,768 to 32,767	2	0
---	Pn102	Backlash compensation time constant	0.01ms	0 to 6400	2	0

The backlash compensation amount is set in Pn101 in command units. The minimum setting unit for the backlash compensation amount, however, depends on the encoder resolution.

Backlash Compensation Parameters (R88D-WT□ + JUSP-NS115)

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn81B	Backlash compensation amount	0.1 command unit	–32,768 to 32,767	2	0
---	Pn81D.0	Compensation function selection	---	0, 1	2	0

The backlash compensation amount is set in Pn81B in 0.1 command units. The minimum setting unit for the backlash compensation amount, however, depends on the encoder resolution.

Backlash Compensation Parameters (R88D-WN□-ML2)

Type	Parameter No.	Parameter name	Unit	Setting range	Data length	Default setting
---	Pn207.2	Backlash compensation selection	---	0 to 2	2	0
---	Pn214	Backlash compensation amount	Command unit	–32,768 to 32,767	2	0
---	Pn215	Backlash compensation constant	0.01 ms	0 to 65535	2	0

The backlash compensation function is set in Pn214 in command units. The minimum setting unit for the backlash compensation amount, however, depends on the encoder resolution.

The direction in which backlash compensation is first applied after execution of SERVO LOCK using the backlash compensation function is set in Servo Parameters *Backlash Compensation Selection* (Pn100) when using R88D-GN□-ML2, *Backlash Compensation Direction* (Pn81D.0) when using R88D-WT□, and *Backlash Compensation Selection* (Pn207.2) when using R88D-WN□-ML2, as follows:

R88D-GN□ -ML2	R88D-WT□ + JUSP-NS115	R88D-WN□ -ML2	Function
Pn100	Pn81D.0	Pn207.2	
0	---	0	No backlash compensation
1	0	1	Compensates in the forward direction. The first backlash compensation direction is forward.
2	1	2	Compensates in the reverse direction. The first backlash compensation direction is forward.

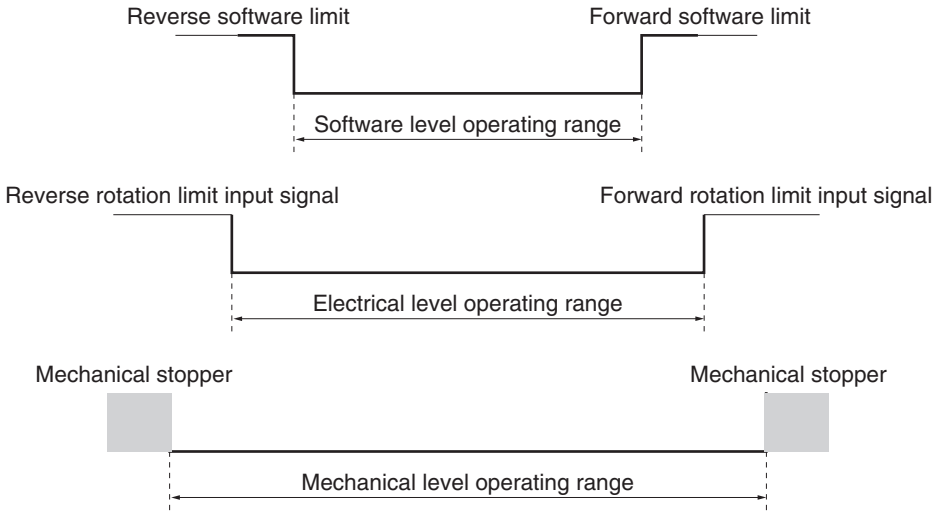
Note When using R88D-WT□ + JUSP-NS115 without backlash compensation, set the backlash compensation amount to (Pn81B) to 0.

10-8 Software Limits

10-8-1 Overview

To prevent or reduce damage to external devices due to unexpected positioning operations when there is a malfunction, in addition to the forward rotation and reverse rotation limit input signals, the PCU also has a function that monitors positioning at a software level. This function is called the “software limit” function.

The range in which the software limit function monitors the position is determined by the values of two settings: the forward software limit and the reverse software limit. Normally, positioning is only possible within the range determined by these software limit settings. The relationship between the forward rotation and reverse rotation limit input signals, the software limits, and the mechanical stoppers used in the system is shown below.



The software limit function is enabled if an origin has been established (i.e., the No Origin Flag is OFF). The software limit function is disabled when the origin has not been established.

When the Servo Drive power is turned ON, the PCU's present position is set to 0, and the origin is not established. RELATIVE MOVEMENT can be executed under these conditions, but the positioning range (present position range possible for positioning) will be –2,147,483,648 to 2,147,483,647 (command units), and the present position will be refreshed by adding the travel distance without an established origin.

If RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range, a Position Designation Error (error code: 3060) will occur when the command is executed.

When a command such as JOG continues to be executed, the present position will be repeated between –2,147,483,648 and 2,147,483,647 (command units). (Refer to *7-3 Coordinate System and Present Position*.)

10-8-2 Procedure for Using Software Limits

The PCU uses the Servo Drive's software limit function. The Servo Parameters for software limits must be set to enable the software limit function. After setting the Servo Parameters, the software limit function is enabled by executing ORIGIN SEARCH and PRESENT POSITION PRESET, or detecting the origin using the absolute encoder.

10-8-3 Software Limit Data Settings

Servo Parameter Area G-series Software Limit Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn104	Software limit function	---	0 to 3	2	0
---	Pn201	Forward software limit	Command unit	–1,073,741,823 to 1,073,741,823	4	500000
---	Pn202	Reverse software limit	Command unit	–1,073,741,823 to 1,073,741,823	4	–500000

W-series and SMARTSTEP Junior Software Limit Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
---	Pn801.0	Software limit function	---	0 to 3	2 (See note 1.)	(See note 2.)
---	Pn801.2	Software limit check using references	---	0 (Do not change the setting.)		0
---	Pn804	Forward software limit	Command unit	−1,073,741,823 to 1,073,741,823	4	819,191,808
---	Pn806	Reverse software limit	Command unit	−1,073,741,823 to 1,073,741,823	4	−819,191,808

Note (1) The data length for Pn801.0 and Pn801.2 is that specified when Servo Parameter Pn801 is transferred.

(2) The default setting for Pn801.0 is 0 when using R88D-WT□, and 3 when using the R88D-WN□-ML2 or a SMARTSTEP Junior Servo Drive.

The software limit settings are provided in the following pages. Set the software limits so that the reverse software limit is less than the forward software limit. If the forward software limit is less than or equal to the reverse software limit, the software limit will always be enabled.

When the software limit function is enabled, the status is indicated by the Forward/Reverse Software Limit Flags in the Axis Operating Input Memory Area, as follows:

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Forward Software Limit Flag	b+1	12	0: Within forward software limit range 1: Forward software limit range exceeded
Reverse Software Limit Flag		13	0: Within reverse software limit range 1: Reverse software limit range exceeded

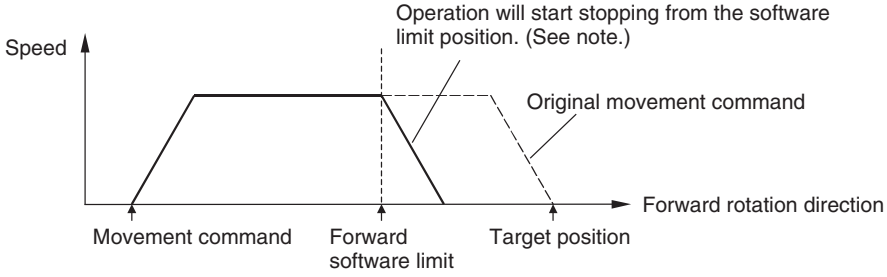
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

10-8-4 Software Limit Operation

The software limit function operates as described in the following table for the present position when the software limits are set.

Software limit function		Software limit by command	
		0: No software limit check using references. (Default setting)	**1: Software limit check using references.**
0	Software limit enabled	When the feedback present position for the active axis reaches the forward/reverse software limit, in the same way as when forward/reverse rotation limit input signals are input, the axis will stop and a Forward/Reverse Software Limit Error (error code: 3002/3003) will occur.	Do not use this setting. Otherwise, the axis operation will not be performed properly.
1	Forward software limit disabled	The forward software limit is disabled. When the feedback present position for the active axis reaches the reverse software limit, the axis will stop and a Reverse Software Limit Error (error code: 3003) will occur in the same way as when a reverse rotation limit input signal is input.	
2	Reverse software limit disabled	The reverse software limit is disabled. When the feedback present position for the active axis reaches the forward software limit, the axis will stop and a Forward Software Limit Error (error code: 3002) will occur in the same way as when a forward rotation limit input signal is input.	
3	Software limit disabled in both directions	The software limits are disabled in both directions. The refresh range and positioning range for the present position is –2,147,483,647 to 2,147,483,647 (command units), and the possible operating range is within the forward/reverse rotation limit input signal range.	

When a movement command is executed using direct operation for which the target position will exceed the software limit range, the operation when the software limit is reached will be as shown in the following diagram.



If RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range (–2,147,483,647 to 2,147,483,647 command units), a Position Designation Error (error code: 3060) will occur when the command is executed.

Note The stop operations when the software limit is reached is the same as when limit input signals are input. For details, refer to *7-5 Limit Input Operations*.

When the axis movement command is executed (after alarm reset) from the position at which the software limit is exceeded (software limit has been detected), the operation will depend on the direction in which the software limit is detected, as follows:

Movement command	Opposite direction of software limit	Direction of software limit
ABSOLUTE MOVEMENT RELATIVE MOVEMENT	Operation is possible. Even if the target position is still beyond the software limit in the direction that has been detected, positioning will be performed to the target position and a Software Limit Error will not be detected even after positioning is completed. If the target position is beyond the software limit in the other direction, a Software Limit Error will occur when the other software limit is reached. If, however, RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range (–2,147,483,647 to 2,147,483,647), a Position Designation Error (error code: 3060) will occur when the command is executed.	A Software Limit Error will occur when the command is executed.
INTERRUPT FEEDING	Operation depends on ABSOLUTE MOVEMENT or RELATIVE MOVEMENT. If the interrupt feeding direction after an interrupt input is opposite to the starting movement direction (reversal operation), the operation is as follows: • If interrupt feeding is performed after passing the software limit in the direction that has been detected. When the interrupt feeding position does not reach the software limit, positioning will be completed. If the software limit will be exceeded due to interrupt feeding, a Software Limit Error will occur when the software limit position is reached again. • If interrupt feeding is executed without passing the software limit in the direction that has been detected, positioning will stop at the reversal position and reverse operation will not be executed due to the Driver's drive prohibited status. In this state, a Software Limit Error will not be detected.	A Software Limit Error will occur when the command is executed.
ORIGIN RETURN	Origin return operations are possible when performed in the opposite direction of the software limit that has been detected. If the origin position exceeds the other software limit, however, a Software Limit Error will occur when the other software limit is reached.	A Software Limit Error will occur when the command is executed.
JOG	Operation is possible. A Software Limit Error will not be detected even if jogging is stopped, or if DECELERATION STOP or EMERGENCY STOP is executed, at a position that is still beyond the software limit in the direction that has been detected. If operation is not stopped, a Software Limit Error will occur when the other software limit is reached.	A Software Limit Error will occur when the command is executed.
SPEED CONTROL TORQUE CONTROL	Operation is possible. A Software Limit Error will not be detected even if DECELERATION STOP or EMERGENCY STOP is executed at a position that is still beyond the software limit in the direction that has been detected. If operation is not stopped, a Software Limit Error will occur when the other software limit is reached.	A Software Limit Error will occur when the command is executed.

Movement command	Opposite direction of software limit	Direction of software limit
PRESENT POSITION PRESET	If PRESENT POSITION PRESET is executed for a position beyond the software limit in the present travel direction, the present position will change and a Software Limit Error will not be detected. If PRESENT POSITION PRESET is executed for a position beyond the software limit in the direction opposite to the travel direction, the present position will change and a Software Limit Error will occur for the software limit in the opposite direction.	
SERVO LOCK	SERVO LOCK can be executed regardless of software limit detection status when using an Incremental Encoder or when using an Absolute Encoder as an Incremental Encoder. When using an Absolute Encoder, operation depends on the unit version of the PCU as follows: PCUs with Unit Version 1.2 or Earlier A software limit error will be detected when SERVO LOCK is executed and the SERVO LOCK operation will be cancelled. Disable the software limit to enable executing SERVO LOCK. PCUs with Unit Version 1.3 or Later SERVO LOCK can be executed regardless of software limit detection status in the same way as when using an Incremental Encoder.	

10-9 Stop Functions

10-9-1 Overview

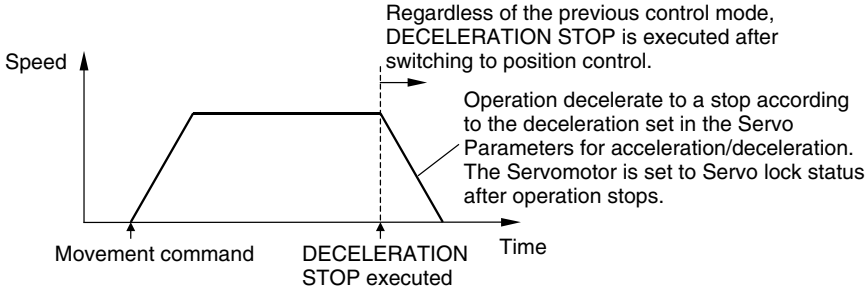
The stop function is used to stop active axes operated by position control, speed control, or torque control. Axis operation can be stopped using the deceleration stop method, which stops the axis using a specified deceleration, or the emergency stop method, which cancels the operating command immediately and stops operation after moving for the remaining pulses in the Servo Drive's deviation counter. Axis operations are also stopped by the PCU if an error occurs.

For details on PCU operations when errors occur, refer to *SECTION 12 Troubleshooting*.

10-9-2 Deceleration Stop

Deceleration stop stops the active axis using the deceleration set in the Servo Parameters when the DECELERATION STOP Bit turns ON in the Axis Operating Output Memory Area. The deceleration stop operation is executed using position control with the specified deceleration curve.

When DECLARATION STOP is executed during speed control or torque control, the feedback speed at that point is used as the start speed, the control mode switches to position control, and operation decelerates to a stop.


Regardless of the previous control mode, DECELERATION STOP is executed after switching to position control.
Speed
Operation decelerate to a stop according to the deceleration set in the Servo Parameters for acceleration/deceleration. The Servomotor is set to Servo lock status after operation stops.
Movement command
DECELERATION STOP executed
Time

DECELERATION STOP can be executed for an axis that is servo-locked as long as SERVO UNLOCK, DEVIATION COUNTER RESET, or EMERGENCY STOP is not being executed and the command bits for these commands are not ON and as long as an axis error has not occurred.

When executing DECELERATION STOP, make sure that the DECELERATION STOP Bit remains ON until the Receiving Command Flag or Stop Execution Flag in the Axis Operating Input Memory Area turns ON.

All axis operation commands except for SERVO UNLOCK, DEVIATION COUNTER RESET, and EMERGENCY STOP will be ignored during DECELERATION STOP execution or while the DECELERATION STOP Bit is ON.

Servo Parameter Area **G-series Acceleration/Deceleration Parameters**

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/ deceleration constants	Pn107	Linear acceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
	Pn10A	Linear deceleration constant	10,000 command units/s^2	–32768 to 32767	2	100
Acceleration/ deceleration filters	Pn10E	Moving average time	0.1 ms	0 to 5100	2	0

W-series and SMARTSTEP Junior Acceleration/Deceleration Parameters

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting	W Series	SMART STEP Junior
Acceleration/ deceleration constants	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Not supported
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100	Supported	Supported
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0	Supported	Not supported
Acceleration/ deceleration filters	Pn810	Exponential acceleration/deceleration bias	Command units/s	0 to 32767	2	0	Supported	Not supported
	Pn811	Exponential acceleration/deceleration time constant	0.1 ms	0 to 5100	2	0	Supported	Not supported
	Pn812	Movement average time	0.1 ms	0 to 5100	2	0	Supported	Not supported

First-step deceleration curve operations require parameter settings for Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drives do not support the following parameters: Pn80D and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. A one-step linear deceleration curve is set using only Pn80E.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
DECELERATION STOP	a	15	0 → 1: Starts deceleration stop.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Busy Flag		13	1: Axis busy (axis operation executing).
Stop Execution Flag		15	0 → 1: Stop operation completed.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

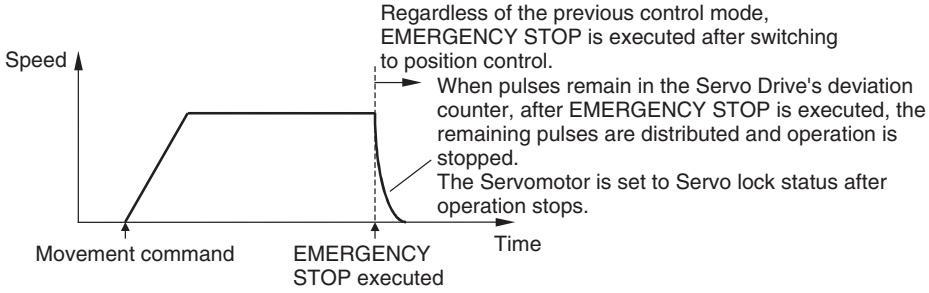
The Stop Execution Flag turns ON when DECELERATION STOP or EMERGENCY STOP is received, but does not check whether the remaining pulses in the Servo Drive are within the positioning completion range, unlike the PCU Positioning Completed Flag in direct operation.

The Stop Execution Flag turns OFF when direct operation, jogging, speed commands or other movement commands are executed.

10-9-3 Emergency Stop

The emergency stop operation cancels the operating command immediately and stops the active axis when the EMERGENCY STOP Bit turns ON in the Axis Operating Output Memory Area.

When EMERGENCY STOP is executed, axis operation switches to position control mode, and stops in Servo locked status. When EMERGENCY STOP is executed during position control, the axis operation distributes the pulses remaining in the Servo Drive's deviation counter and then stops.


Regardless of the previous control mode, EMERGENCY STOP is executed after switching to position control.
When pulses remain in the Servo Drive's deviation counter, after EMERGENCY STOP is executed, the remaining pulses are distributed and operation is stopped.
The Servomotor is set to Servo lock status after operation stops.
Speed
Time
Movement command
EMERGENCY STOP executed

EMERGENCY STOP can be executed for an axis that is servo-locked as long as SERVO UNLOCK or DEVIATION COUNTER RESET is not being executed and the command bits for these commands are not ON and as long as an axis error has not occurred.

When executing EMERGENCY STOP, make sure that the EMERGENCY STOP Bit remains ON until the Receiving Command Flag or Stop Execution Flag in the Axis Operating Input Memory Area turns ON.

All axis operation commands except for SERVO UNLOCK and DEVIATION COUNTER RESET will be ignored during EMERGENCY STOP execution or while the EMERGENCY STOP Bit is ON.

Axis Operating Output Memory Areas (Operating Commands)

Name	Word	Bits	Contents
EMERGENCY STOP	a+1	15	0 → 1: Starts emergency stop.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Areas (Monitoring)

Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Busy Flag		13	1: Axis busy (axis operation executing).
Stop Execution Flag		15	0 → 1: Stop operation completed.

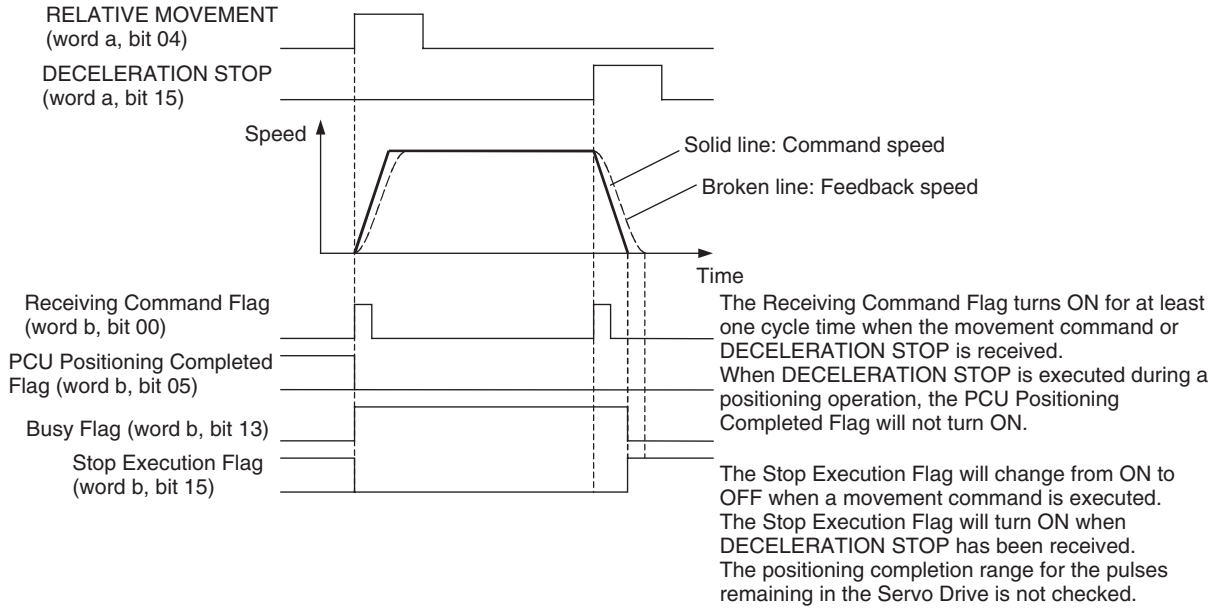
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Stop Execution Flag turns ON when DECELERATION STOP or EMERGENCY STOP is received, but does not check whether the remaining pulses in the Servo Drive are within the positioning completion range, unlike the PCU Positioning Completed Flag in direct operation.

The Stop Execution Flag turns OFF when direct operation, jogging, speed commands or other movement commands are executed.

10-9-4 Stop Function Timing Chart

The following timing chart is for when DECELERATION STOP is executed. The timing chart for EMERGENCY STOP is the same, except that operation is stopped after distributing the pulses remaining in the Servo Drive.


RELATIVE MOVEMENT
(word a, bit 04)
DECELERATION STOP
(word a, bit 15)
Speed
Solid line: Command speed
Broken line: Feedback speed
Time
Receiving Command Flag
(word b, bit 00)
PCU Positioning Completed
Flag (word b, bit 05)
Busy Flag (word b, bit 13)
Stop Execution Flag
(word b, bit 15)
The Receiving Command Flag turns ON for at least one cycle time when the movement command or DECELERATION STOP is received.
When DECELERATION STOP is executed during a positioning operation, the PCU Positioning Completed Flag will not turn ON.
The Stop Execution Flag will change from ON to OFF when a movement command is executed.
The Stop Execution Flag will turn ON when DECELERATION STOP has been received.
The positioning completion range for the pulses remaining in the Servo Drive is not checked.

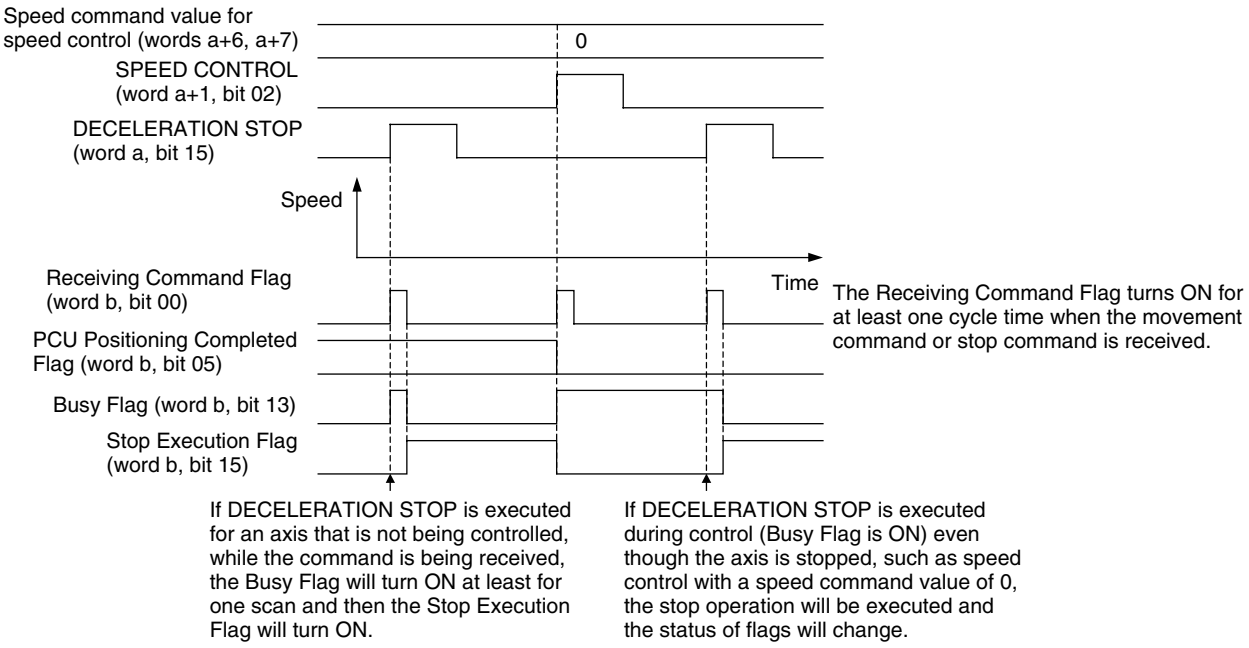
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

When DECELERATION STOP or EMERGENCY STOP is executed during direct operation (ABSOLUTE MOVEMENT/RELATIVE MOVEMENT) or ORIGIN SEARCH, the PCU Positioning Completed Flag will not turn ON when operation stops. Even if the stop position for DECELERATION STOP/EMERGENCY STOP is within the positioning completion range of the target position for the initial positioning operation, the PCU Positioning Completed Flag will not turn ON.

The status of the Receiving Command Flag, Busy Flag, and Stop Execution Flag will change if DECELERATION STOP or EMERGENCY STOP is executed when an axis operating command is not being executed.

The stop operation will also be performed in the same way as for an active axis if still in the controlled status while the axis is being stopped (Busy Flag is ON), such as during direct operation, jogging, when the speed command value is set to 0 for speed control, or when the axis is being stopped during torque control.

Example: Executing DECELERATION STOP for Speed Control with a Speed Command Value of 0


Speed command value for speed control (words a+6, a+7)
0
SPEED CONTROL (word a+1, bit 02)
DECELERATION STOP (word a, bit 15)
Speed
Time
Receiving Command Flag (word b, bit 00)
PCU Positioning Completed Flag (word b, bit 05)
Busy Flag (word b, bit 13)
Stop Execution Flag (word b, bit 15)
The Receiving Command Flag turns ON for at least one cycle time when the movement command or stop command is received.
If DECELERATION STOP is executed for an axis that is not being controlled, while the command is being received, the Busy Flag will turn ON at least for one scan and then the Stop Execution Flag will turn ON.
If DECELERATION STOP is executed during control (Busy Flag is ON) even though the axis is stopped, such as speed control with a speed command value of 0, the stop operation will be executed and the status of flags will change.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. –1) × 25

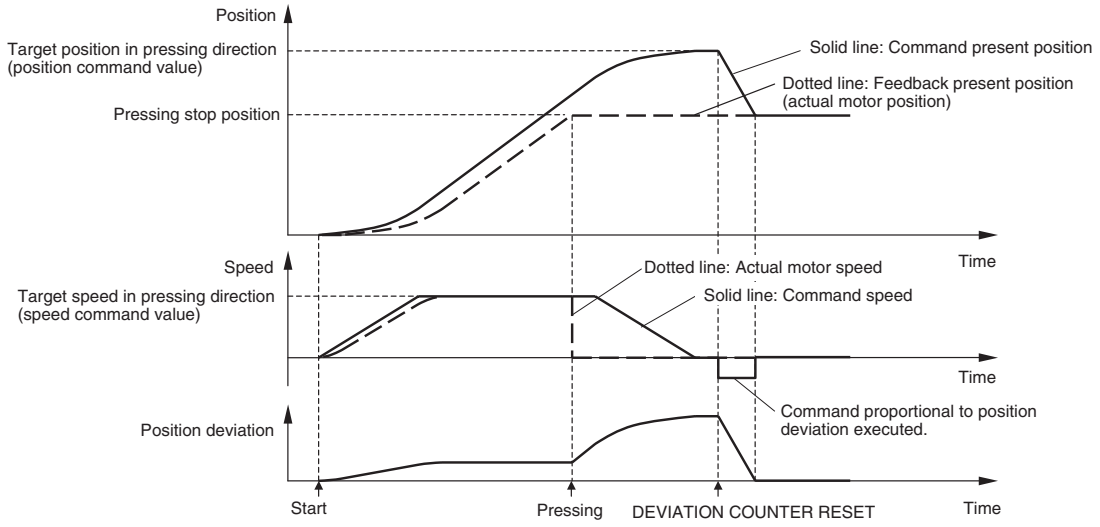
10-10 DEVIATION COUNTER RESET

10-10-1 Overview of DEVIATION COUNTER RESET

The deviation counter can be reset during position control for PCUs with unit version 1.3 or later.

The deviation counter reset function resets to 0 the position deviation accumulating in the Servo Drive's position loop deviation counter during position control. When pressing using torque control, when the machine catches and stops moving, or in other cases when the command present position and the feedback present position vary greatly, the positioning operation may not finished because the position deviation never becomes less than the completion width. DEVIATION COUNTER RESET can be used in such cases to reset the accumulated position deviation to 0 and thus complete the positioning operation.

With this function, the PCU's deviation counter reset function uses a movement command in the direction opposite to and the same size as the accumulated position deviation so that the command present position will match the feedback present position.



DEVIATION COUNTER RESET is valid only during position control after the servo has been locked and will be ignored if executed during speed control or torque control, or when the servo is unlocked.

Note Execute the PCU's DEVIATION COUNTER RESET only while the motor axis (machine) is stopped, by being pressed against something for example. This function executes a movement command in the direction opposite to and of the same size as the accumulated position deviation, so the machine may be subjected to shock if a movement command in the opposite direction is suddenly executed for a rotating axis. Also, do not execute DEVIATION COUNTER RESET for a vertical axis that is stopped by a servo lock only, without being held mechanically. While the vertical axis is servo-locked, the axis is controlled so that the vertical position is held using the accumulated position deviation. Therefore, executing a deviation counter reset may cause the motor load to fall.

10-10-2 Using DEVIATION COUNTER RESET

DEVIATION COUNTER RESET is executed by turning ON the DEVIATION COUNTER RESET Bit in the Axis Operating Output Area to execute a movement command that effectively cancels the position deviation.

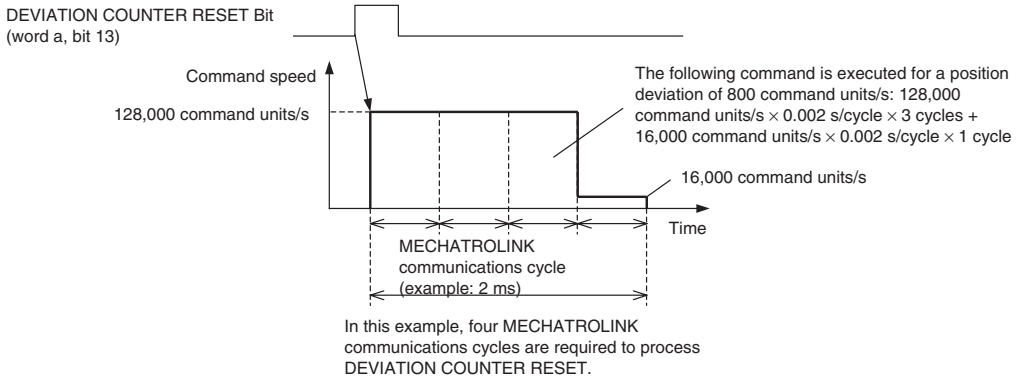
DEVIATION COUNTER RESET executes position control according to the position deviation at a maximum speed of 128,000. If the accumulated position deviation is large, processing time equivalent to several MECHATROLINK communications cycles will be required to complete resetting the deviation counter.

Example

MECHATROLINK communications cycle: 2 ms

Position deviation: 800 (command units)

The movement command executed for DEVIATION COUNTER RESET will be as shown below for the above conditions. The direction will be so that the position deviation is eliminated.


DEVIATION COUNTER RESET Bit
(word a, bit 13)
Command speed
128,000 command units/s
The following command is executed for a position deviation of 800 command units/s: 128,000 command units/s × 0.002 s/cycle × 3 cycles + 16,000 command units/s × 0.002 s/cycle × 1 cycle
16,000 command units/s
Time
MECHATROLINK communications cycle (example: 2 ms)
In this example, four MECHATROLINK communications cycles are required to process DEVIATION COUNTER RESET.

In this example, the movement command to eliminate the position deviation of 800 command units exceeds the movement possible in one MECHATROLINK communications cycle at a speed of 128,000 command units/s, so the command is executed over multiple cycles (four total).

When DEVIATION COUNTER RESET is executed, the torque limit does not depend on the setting of the Torque Limit Designation Bit, but on the status in the previous axis operation. (The previous torque limit status is continued, and DEVIATION COUNTER RESET is executed.)

Axis Operating Output Area (Operation Commands)

Name	Word	Bit	Description
DEVIATION COUNTER RESET Bit	a	13	0 → 1: Deviation counter reset started.

a = Beginning word of Axis Operating Output Area specified in Common Parameters + (Axis No. − 1) x 25

A deviation counter reset can be executed for any axis for which position control that includes a Servo lock is being executed, as long as there is no axis error, the Servo is locked, and the Servo Unlock Bit is not ON. The command is invalid if executed during speed control or torque control, or when the Servo is unlocked.

When executing a deviation counter reset, keep the Deviation Counter Reset Bit ON until Receiving Command Flag turns ON in the Axis Operating Output Area or until the Busy Flag is turned OFF.

While the Deviation Counter Reset Bit is ON and a deviation counter reset is being executed, all operation commands other than SERVO UNLOCK are disabled.

Axis Operating Input Area (Monitoring)

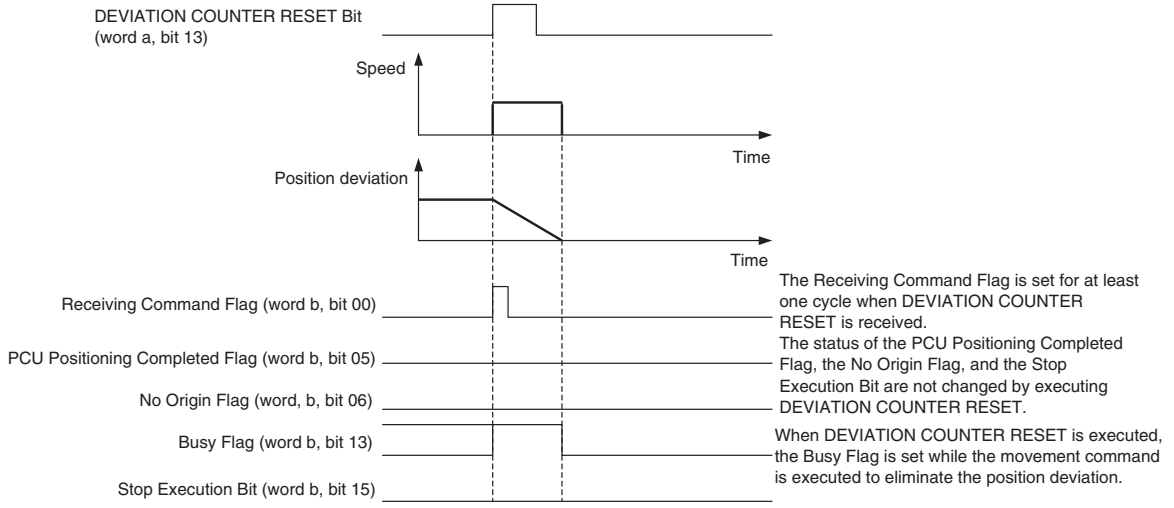
Name	Word	Bits	Contents
Receiving Command Flag	b	00	0: Command reception enabled. 0 → 1: Command reception started. 1: Receiving command (command reception disabled).
Error Flag		12	0: No axis error 1: Axis error has occurred.
Busy Flag		13	1: Axis busy (axis operation executing).

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

The status of the PCU Positioning Completed Flag, the No Origin Flag, and the Stop Execution Bit are not changed by turning ON the DEVIATION COUNTER RESET Bit. When the DEVIATION COUNTER RESET is executed, the Busy Flag is held.

Timing Chart

The timing chart for DEVIATION COUNTER RESET is shown below.


DEVIATION COUNTER RESET Bit (word a, bit 13)
Speed
Time
Position deviation
Time
Receiving Command Flag (word b, bit 00)
PCU Positioning Completed Flag (word b, bit 05)
No Origin Flag (word, b, bit 06)
Busy Flag (word b, bit 13)
Stop Execution Bit (word b, bit 15)
The Receiving Command Flag is set for at least one cycle when DEVIATION COUNTER RESET is received.
The status of the PCU Positioning Completed Flag, the No Origin Flag, and the Stop Execution Bit are not changed by executing DEVIATION COUNTER RESET.
When DEVIATION COUNTER RESET is executed, the Busy Flag is set while the movement command is executed to eliminate the position deviation.

a = Beginning word of Axis Operating Output Area specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Area specified in Common Parameters + (Axis No. −1) × 25

SECTION 11
Sample Programs

This section provides basic program examples and application examples for using the Position Control Unit.

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11-1 Overview

This section shows sample programs that execute the various PCU functions from the ladder program.

Refer to *11-2 Basic Program Examples* for descriptions of the sample ladder program sections containing the functions. Refer to *11-3 Application Examples* for sample programs that combine those various program sections.

This section explains the example system and conditions used for the sample programs.

Note The sample programs shown in this section use the PCU's functions and are configured only with ladder programs related to the interface between the PLC and PCU.
When creating the program for the actual equipment in the system, add program sections to perform tasks such as interlocking the equipment's movement, managing I/O from other equipment, and controlling operation so that the program will provide the required operating commands to the PCU.
In addition, always test the new program thoroughly to verify proper operation before switching to full-scale operation in the system.

Devices in the Sample System

Position Control Unit

CJ1W-NCF71
Unit number: 0 (Beginning word of Common Operating Memory Area: CIO 1500)

Only one PCU is used in the PLC.

When a different unit number is required, use the following equation to determine the beginning word of Common Operating Memory Area.

Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)

MECHATROLINK Devices (Servo Drives)

W-series Servo Drive (R88D-WT□)
JUSP-NS115 MECHATROLINK-II Application Module mounted to Servo Drive

Axis 1 (MECHATROLINK-II station address 1) is used to demonstrate axis operation in these sample ladder programs.

When a different number of axes or station number is required, use the following equation to determine the beginning CIO word addresses for each axis.

Beginning word of Axis Operating Output Memory Area for Axis N:
Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Beginning word of Axis Operating Input Memory Area for Axis N:
Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Refer to *11-3-1 Initial PCU Settings* for an example that shows how to set the beginning words of Axis Operating Input/Output Areas.

The standard settings are used for the Servo Drive's I/O signals; for details on the standard settings, refer to *6-4 Standard Settings for Servo Drives Using MECHATROLINK*.

CPU Unit

Model number: CJ1H-CPU□□

In *11-3 Application Examples*, the CPU Unit's EM Area is used to store the PCU's Common Parameter, Axis Parameter, and Servo Parameter data.

If the CJ1H-CPU□□ CPU Unit being used is not equipped with an EM Area, change the storage area to an unused section of the DM Area.

Installation and Wiring

Install and wire the devices according to the directions in *SECTION 3 Installation and Wiring*.

Connect a 24-VDC control input power supply for the Servo Drive's I/O signals and connect normally closed switches/sensors for the positive and negative overtravel inputs (forward drive prohibited and reverse drive prohibited signals).

Also, when an origin search operation is to be executed, connect a normally open switch/sensor for the origin proximity input signal (origin return deceleration LS).

11-2 Basic Program Examples

This section provides sample ladder programs related to the PCU's basic functions.

11-2-1 Transferring PCU Parameters

Overview

The parameters set in the PCU (Common Parameters and Axis Parameters) can be transferred to and from the CPU Unit's EM Area using the READ DATA Bit and WRITE DATA Bit.

Also, the parameters that have been written to the PCU can be saved to the PCU's internal flash memory using the SAVE DATA Bit.

These sample programs use the following parts of the CPU Unit's I/O memory.

CPU Bus Unit Area

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

Data Memory Area (DM Area)

D10000 to D10039

These words contain the write data when writing or the read data when reading.

In this sample program, 40 words of data are written and read, and D10000 is specified as the starting word, so D10000 to D10039 are used.

Work Area (WR Area)

Writing data: W300.00 to W300.06
Reading data: W301.00 to W301.06
Saving data: W302.00 to W302.06

These Work Area bits are used to show the progress of function execution and the execution status.

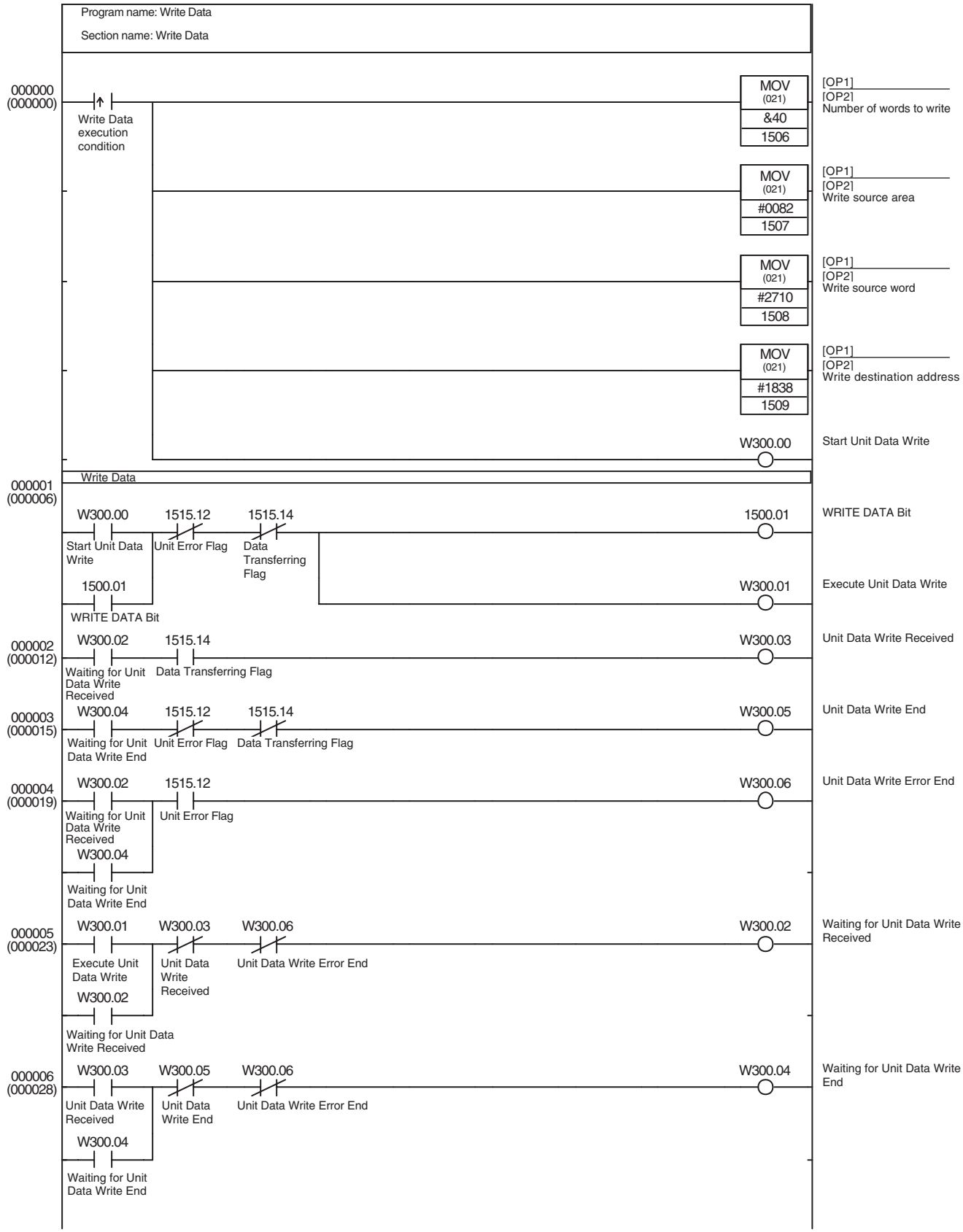
Writing Data

Use the WRITE DATA Bit in the Common Operating Memory Area to write the write data prepared in the DM Area of the CPU Unit to the PCU.

When the execution condition for the write operation goes ON, the 40 words of write data (preset in the CPU Unit's DM Area starting at D10000) are transferred to the PCU's internal memory starting at address 1838 hex.

When the data has been written, W300.05 is turned ON for one cycle.

Sample Ladder Program



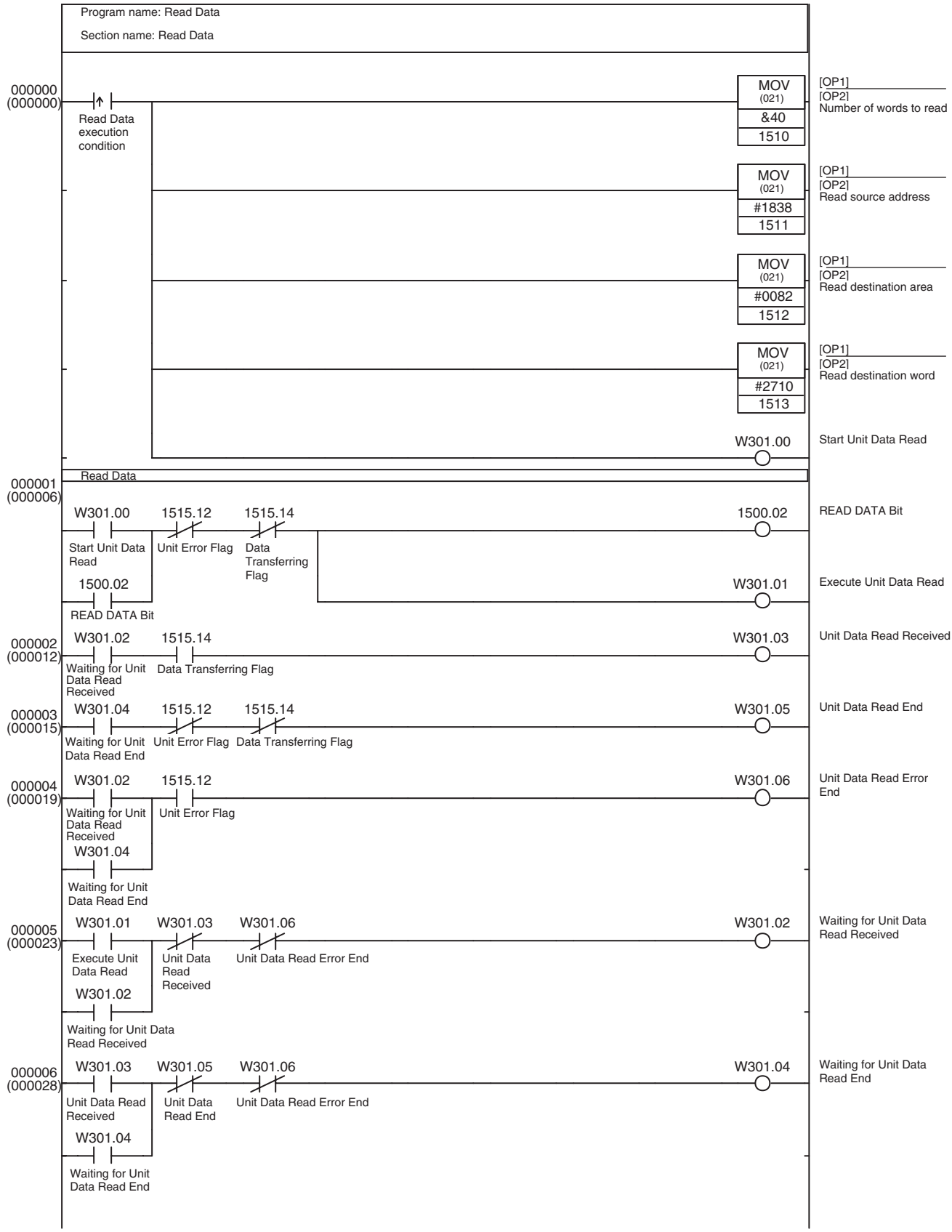
Reading Data

Use the READ DATA Bit in the Common Operating Memory Area to read the read data from the PCU's internal memory to the CPU Unit's DM Area.

When the execution condition for the read operation goes ON, the 40 words of read data are read from the PCU's internal memory (starting at address 1838 hex) to the CPU Unit's DM Area (starting at D10000).

When the data has been read, W301.05 is turned ON for one cycle.

Sample Ladder Program



Saving Data

Use the SAVE DATA Bit in the Common Operating Memory Area to save the PCU's Common Parameters and Axis Parameters to the PCU's flash memory.

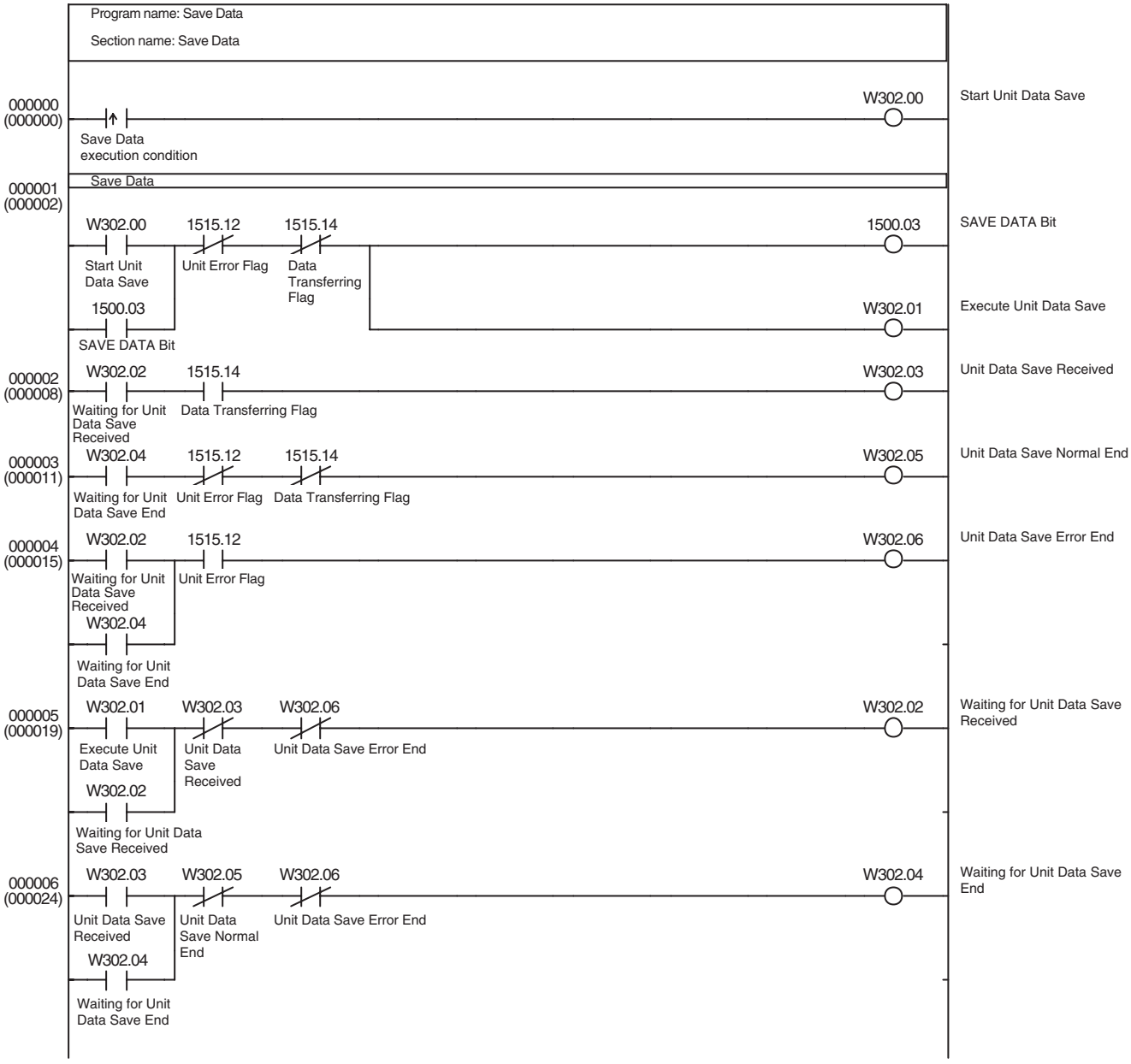
The PCU's Save Data operation is executed when the Save Data execution condition goes from OFF to ON.

When the data has been saved, W302.05 is turned ON for one cycle.

The Save Data operation cannot be executed while MECHATROLINK communications are active. If the Save Data is executed during MECHATROLINK communications, a Multi-start Error (Unit error code: 0021).

Execute this sample program only when MECHATROLINK communications are stopped.

Sample Ladder Program



11-2-2 Starting and Stopping MECHATROLINK Communications

Overview

This program starts MECHATROLINK communications (establishes a connection) based on the MECHATROLINK communications settings and the scan list set in the PCU's Common Parameters; the program can also stop communications (release the connection).

While the PCU connection is established, MECHATROLINK communications will be stopped automatically if normal communications are not established with all of the axes registered in the scan list within the preset timeout time.

(If the PCU cannot start communications with an axis registered in the scan list within 10 seconds, an MLK Initialization Error will occur. This sample program contains a timer function that stops communications before the MLK Initialization Error is detected.)

This program uses the MECHATROLINK communications settings and the scan list that are already set in the PCU's Common Parameters.

This sample program uses the following parts of the CPU Unit's I/O memory.

CPU Bus Unit Area

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

Work Area (WR Area)

W303.00 to W303.04

These Work Area bits are used to show the progress of function execution and the execution status.

Timer Area

TIM0000

Used as a watchdog timer to monitor the establishment of a connection.

This program uses the CONNECT Bit in the Common Operating Memory Area to start and stop MECHATROLINK communications.

When the Start Communications condition goes ON, MECHATROLINK communications are started (a connection is established). Likewise, when the Stop Communications condition goes ON, MECHATROLINK communications are stopped (the connection is released).

In this sample program, only Axis 1 is registered in the scan list.

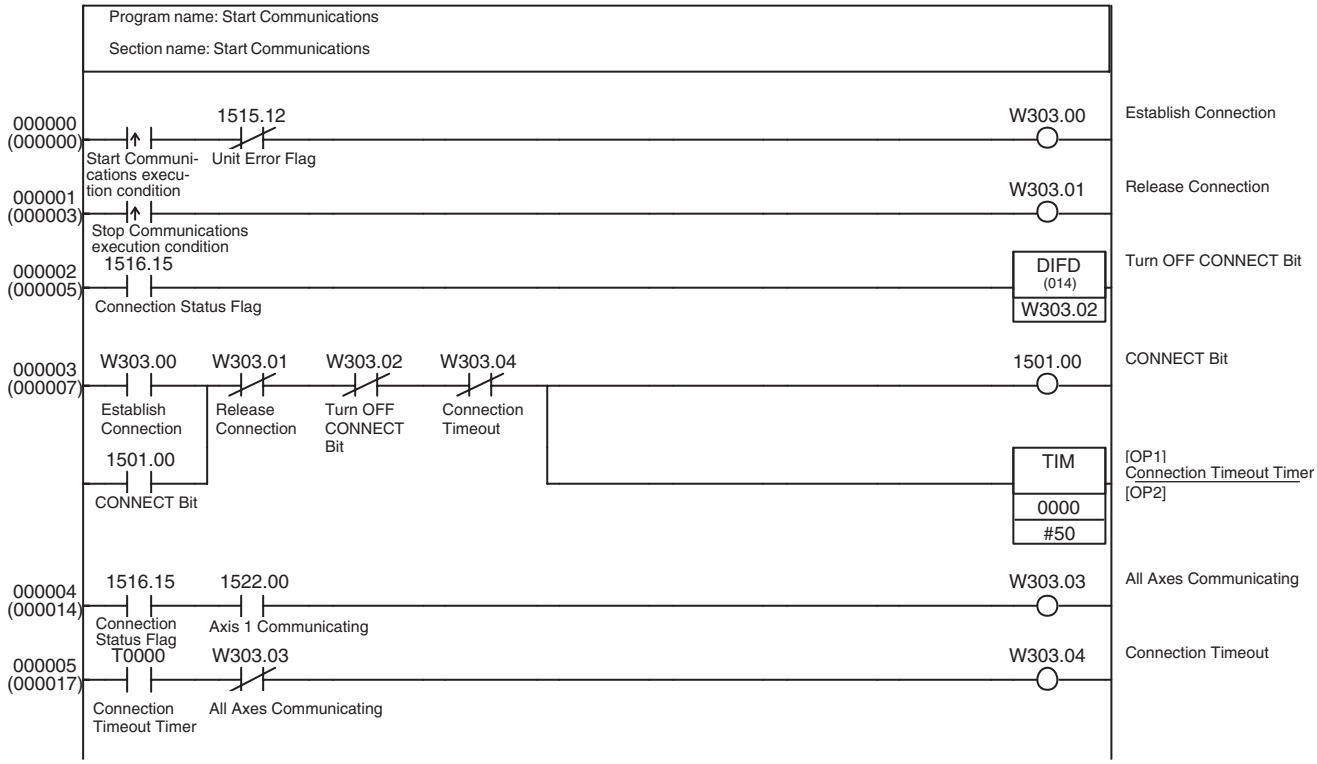
If MECHATROLINK communications start normally with Axis 1, Work Area bit W303.03 will be turned ON.

The connection will be stopped and Work Area bit W303.04 will be turned ON if MECHATROLINK communications do not start with Axis 1 5 seconds after execution of CONNECT.

Since the PCU will continue MECHATROLINK communications while the CONNECT Bit (CIO 1501.00) is ON, the CONNECT Bit is programmed as a self-holding bit in the ladder program. If an error occurs that stops communications, such as a communications error, the PCU will release the connection regardless of the status of the CONNECT Bit.

To reestablish the connection after eliminating the cause of the error, the CONNECT Bit must be turned OFF and then ON again. When releasing the connection after an error occurs, use W303.02 to turn OFF the self-holding circuit that holds the CONNECT Bit.

Sample Ladder Program



11-2-3 Transferring Servo Parameters

Overview

The Servo Parameters in Servo Drives connected through MECHATROLINK communications can be transferred to and from the CPU Unit's DM Area with the PCU's WRITE SERVO PARAMETER Bit, READ SERVO PARAMETER Bit, and SAVE SERVO PARAMETER Bit.

The application example shown in *11-3-2 Servo Parameter Backup* incorporates this sample program to transfer all the W-series Servo Drive's Servo Parameters at once between the Servo Drive (equipped with a JUSP-NS115 Application Module) and the CPU Unit's EM Area.

Execute these sample programs only after starting MECHATROLINK communications (establishing a connection).

In these examples, the Servo Parameters are transferred to and from the Servo Drive registered as axis 1.

The Axis Operating Output/Input Memory Areas for the axis are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Data Memory Area (DM Area)

D10500 to D10503

These words are used to store the data required for a single Servo Parameter transfer, including the Servo Parameter number, parameter size, and transfer data (2 words).

Work Area (WR Area)

Writing Servo Parameters: W400.00 to W400.06
Reading Servo Parameters: W401.00 to W401.06
Saving Servo Parameters: W402.00 to W402.06

These Work Area bits are used to show the progress of function execution and the execution status.

Writing Servo Parameters

Use the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area to write the Servo Parameter data (preset in the CPU Unit's DM Area) to the Servo Drive.

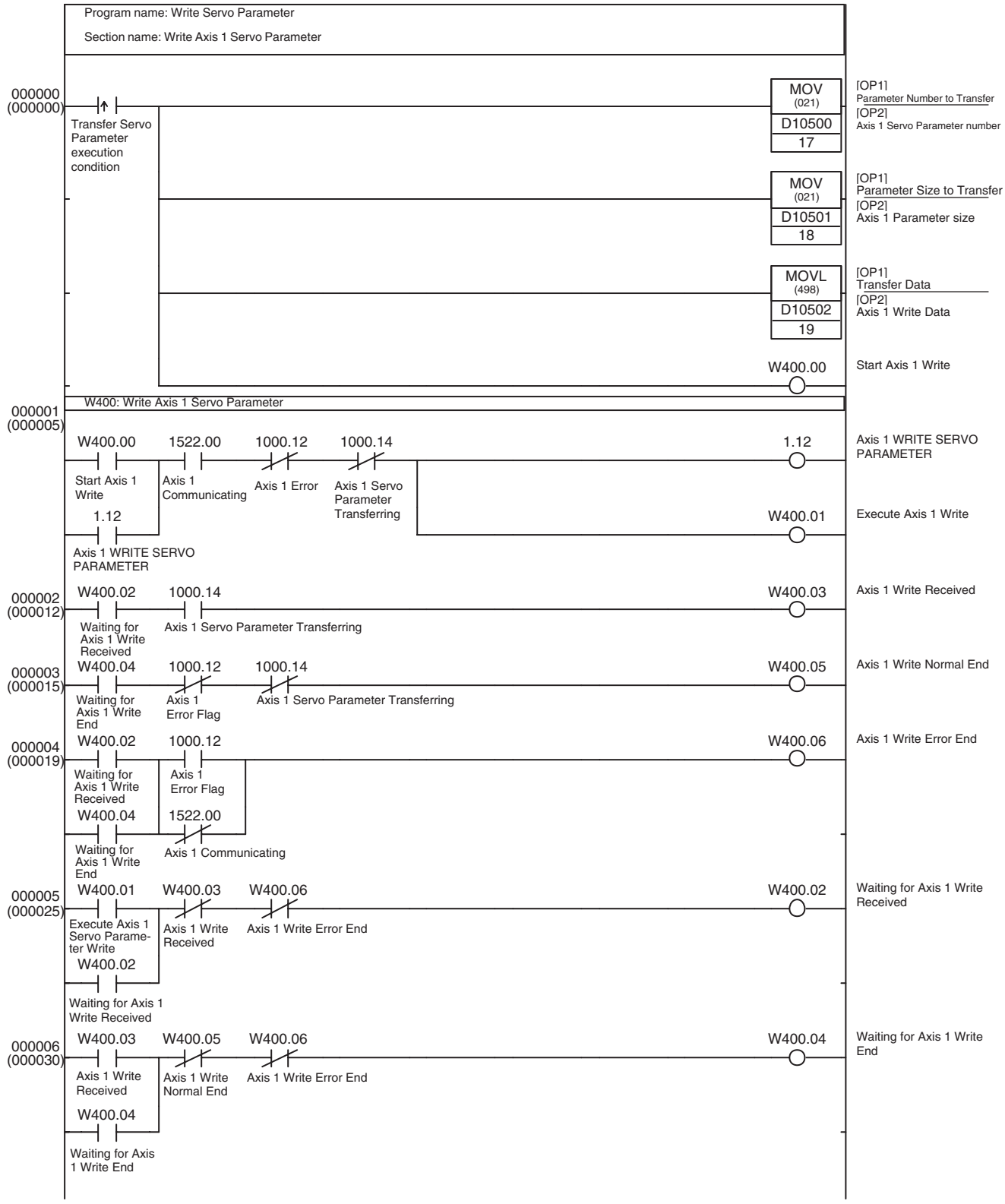
When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameters preset in the following DM Area words will be transferred to the Servo Drive.

Word	Details
D10500	Servo Parameter No.
D10501	Parameter size (Unit: bytes)
D10502	Write data (rightmost word)
D10503	Write data (leftmost word)

When the Servo Parameter data has been written, W400.05 is turned ON for one cycle.

When the write operation was not completed normally, i.e., an error occurred during the transfer, W400.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)

Sample Ladder Program



Reading Servo Parameters

Use the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area to read the Servo Parameters from the Servo Drive to the CPU Unit's DM Area.

When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameter (specified in the DM Area as shown below) will be read.

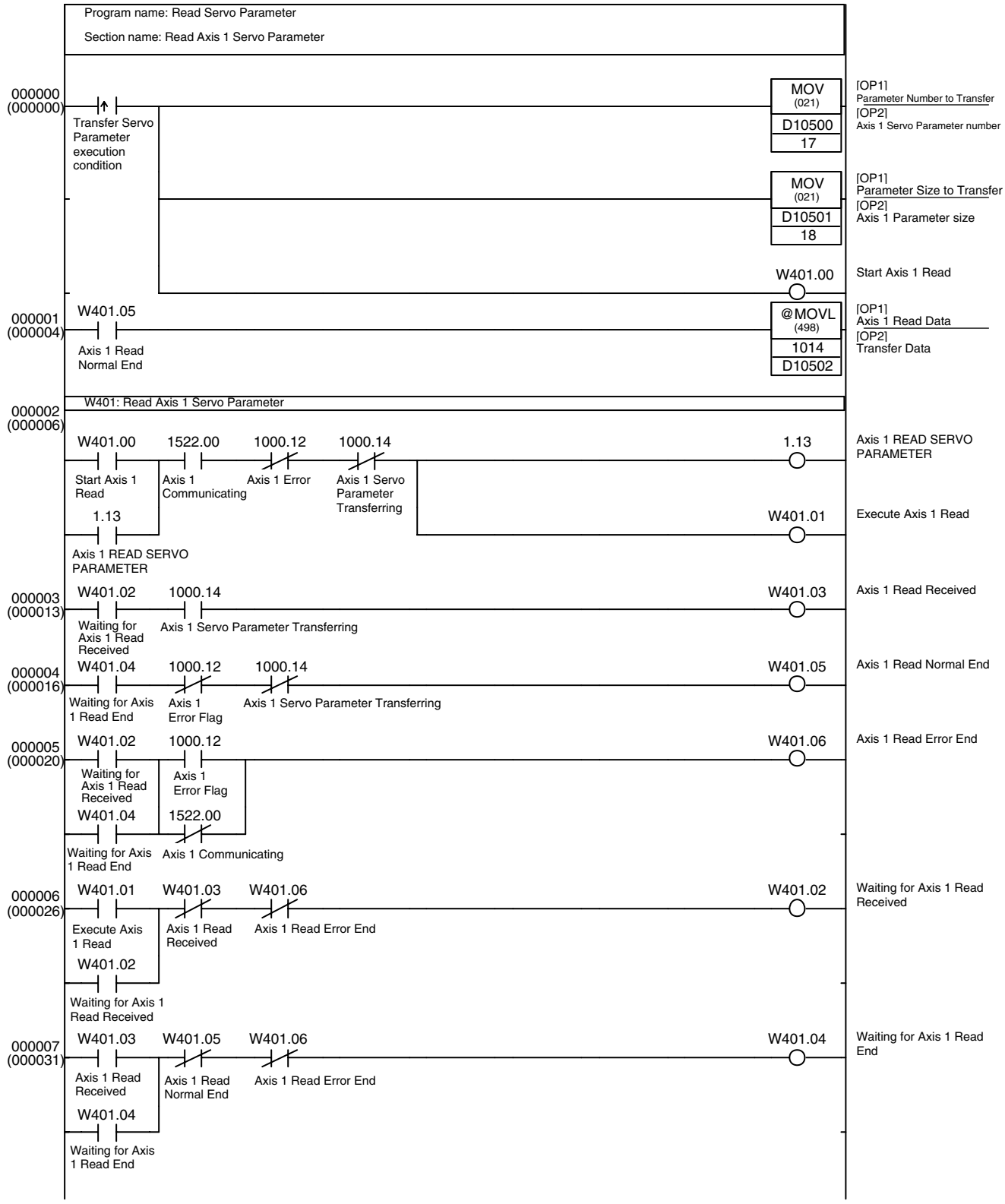
Word	Details
D10500	Servo Parameter No.
D10501	Parameter size (Unit: bytes)

When the Servo Parameter data has been read normally, W401.05 is turned ON for one cycle and the parameter is stored in the DM Area as shown in the following table.

Word	Details
D10502	Read data (rightmost)
D10503	Read data (leftmost)

When the read operation was not completed normally, i.e., an error occurred during the transfer, W401.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)

Sample Ladder Program



Saving Servo Parameters

Use the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area to write the transfer data (preset in the CPU Unit's DM Area) to the Servo Drive's non-volatile flash memory.

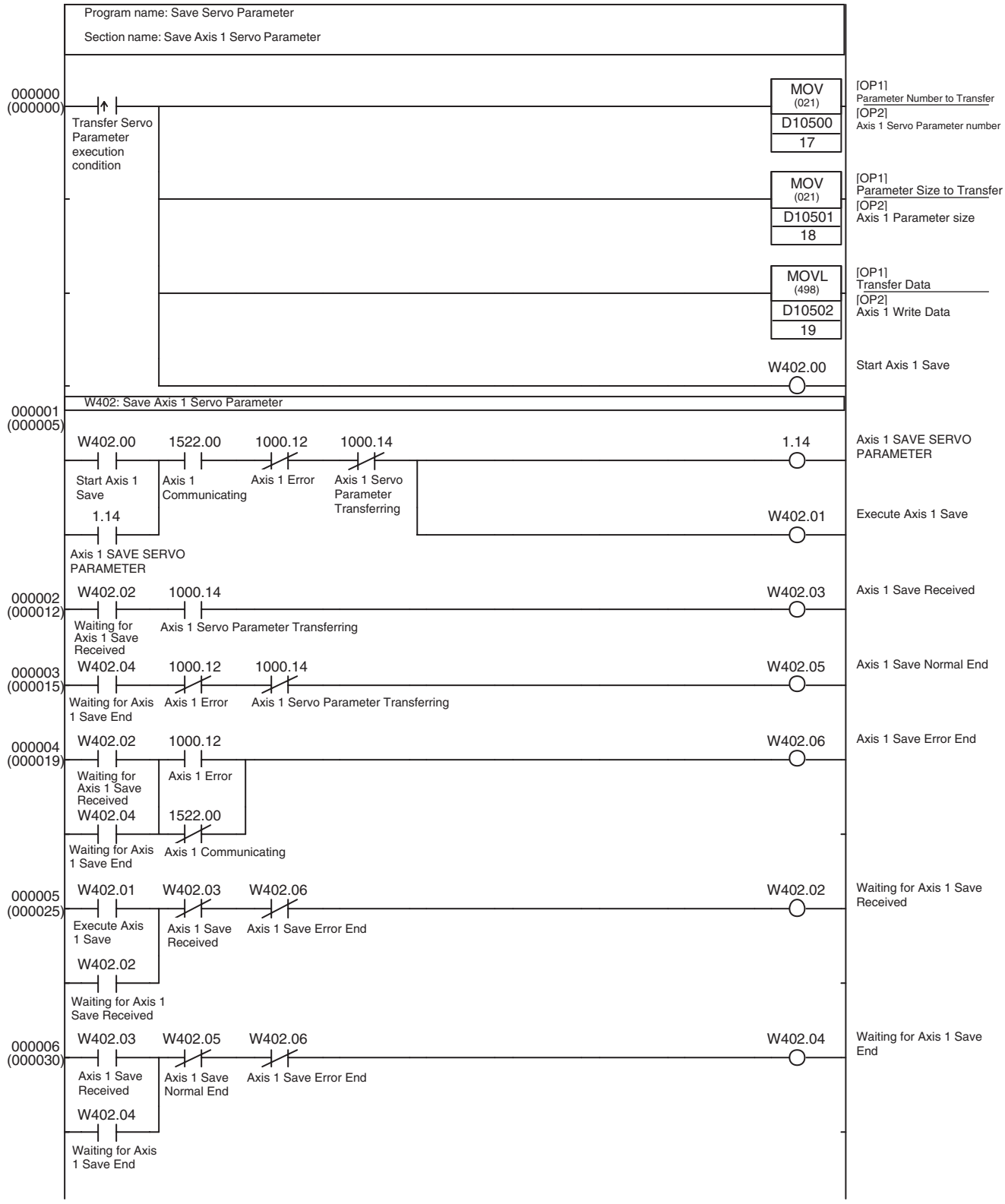
When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameters preset in the following DM Area words will be transferred to the Servo Drive and written to the Servo Drive's non-volatile flash memory at the same time.

Word	Details
D10500	Servo Parameter No.
D10501	Parameter size (Unit: bytes)
D10502	Write data (rightmost word)
D10503	Write data (leftmost word)

When the Servo Parameter data has been saved normally, W402.05 is turned ON for one cycle.

When the save operation was not completed normally, i.e., an error occurred during the transfer, W402.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)

Sample Ladder Program



11-2-4 Servo Lock/Unlock

Overview

This sample program executes the Servo Lock/Unlock function on a Servo Drive connected through MECHATROLINK communications.

Also, timeout processing will be performed when the Servo Lock function has been executed but the Servo Lock did not engage for the axis within a preset time.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection).

In this example, the Servo Lock/Unlock function is executed on the Servo Drive registered as axis 1 using the SERVO LOCK Bit or SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Work Area (WR Area)

W305.00 to W305.05

These Work Area bits are used to show the progress of function execution and the execution status.

Timer Area

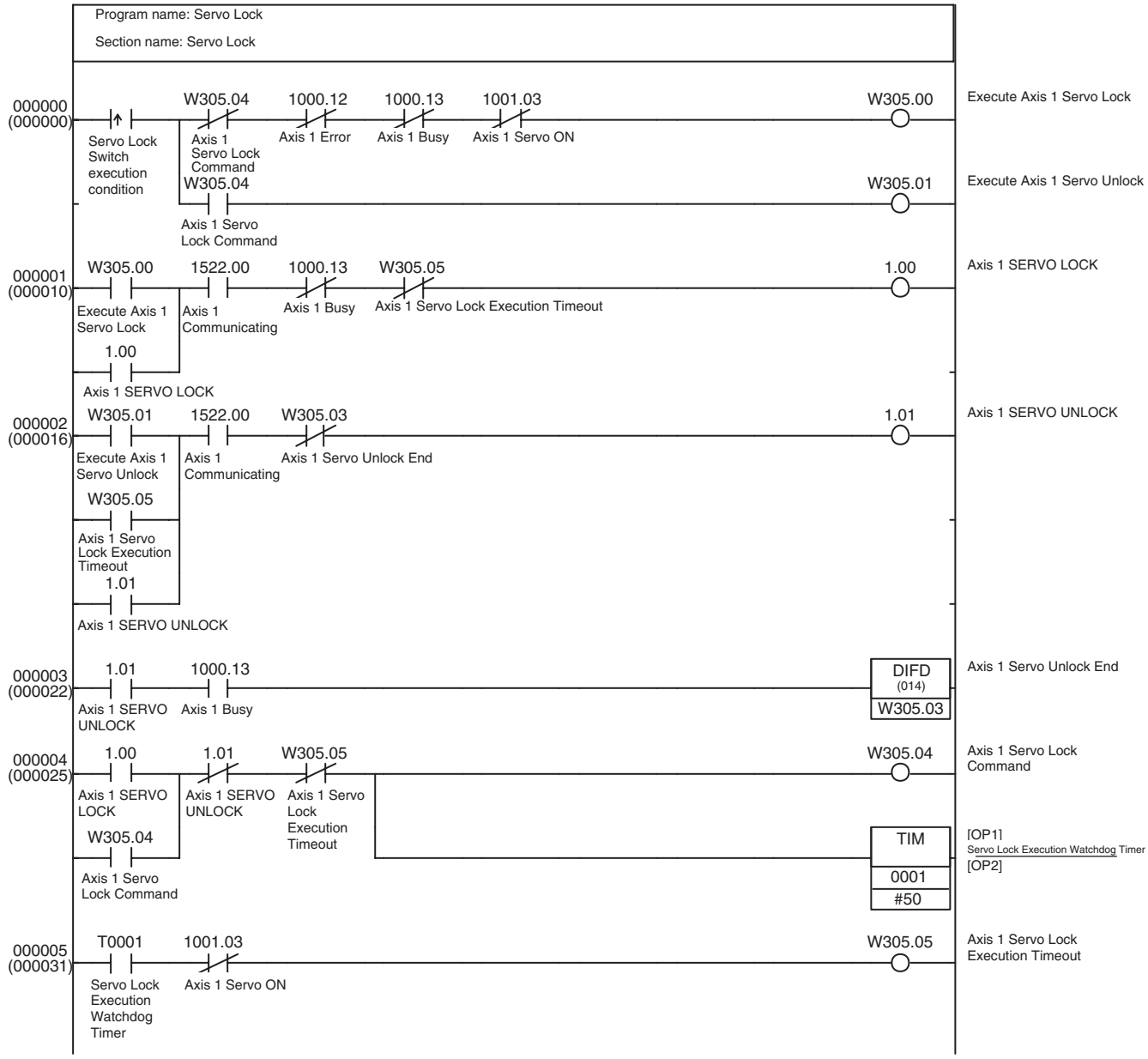
TIM0001

Used as a watchdog timer to monitor the execution of the Servo Lock function.

This sample program alternately executes the Servo Lock and Servo Unlock functions each time that the Servo Lock Switch execution condition goes from OFF to ON.

If the Axis 1 Servo Lock is not engaged within 5 seconds after the Servo Lock function is executed, a Servo Lock Execution Timeout will occur, bit W305.05 will be turned ON for one cycle, and the Servo Unlock function will be executed.

Sample Ladder Program



Note With the above programming example, if the Servo is unlocked by any means other than the SERVO UNLOCK command bit (e.g., if a Driver main circuit OFF error occurs), the status of the work bit will be held. When using this programming example as reference for actual programming, add interlocks suitable for the operating conditions of the equipment.

11-2-5 Origin Search

Overview

This sample program executes an origin search on a Servo Drive connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In these examples, the origin search is performed on the Servo Drive registered as axis 1.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Work Area (WR Area)

W350.00 to W350.02

These Work Area bits are used to show the progress of function execution and the execution status.

Timer Area

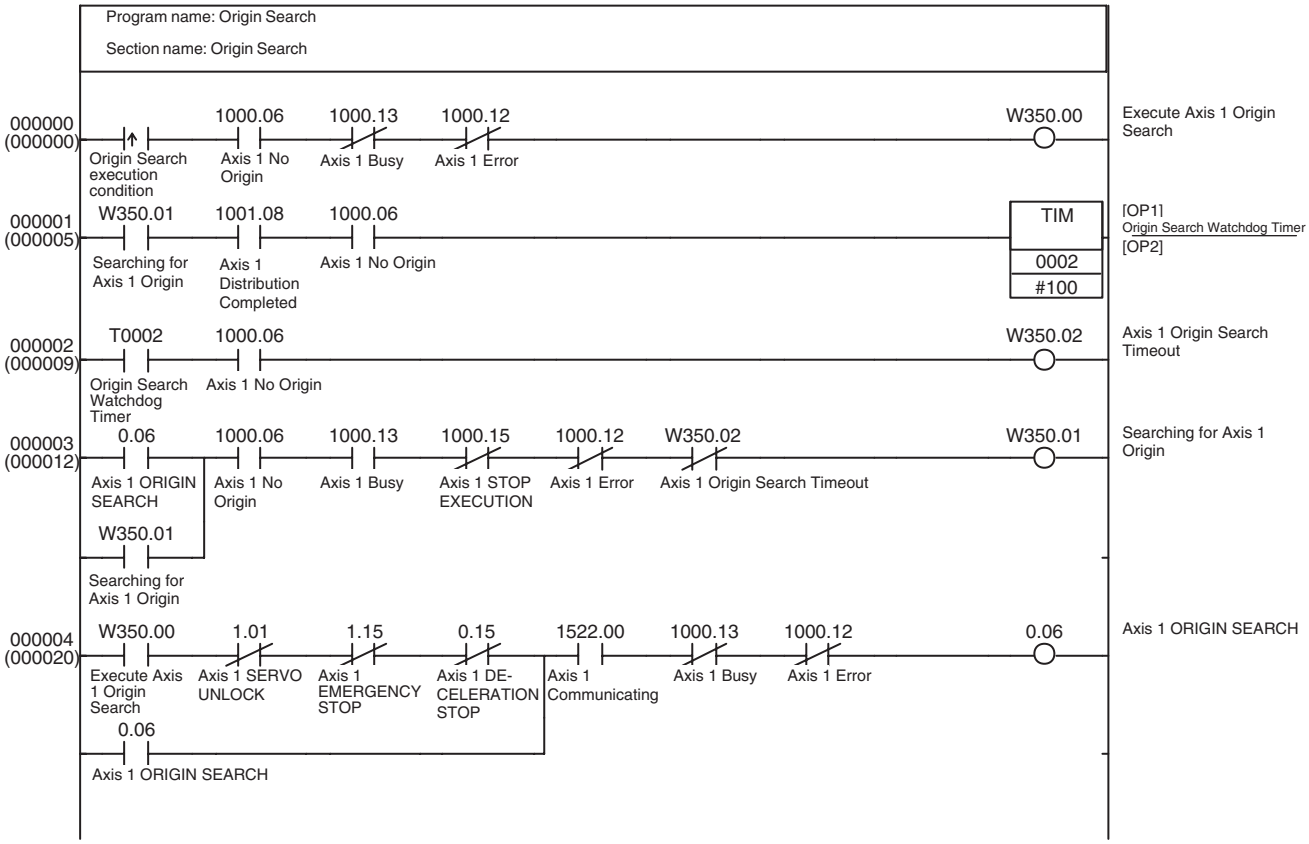
TIM0002

Used as a watchdog timer to detect an origin search timeout error.

This sample program starts an origin search on axis 1 when the Origin Search execution condition goes from OFF to ON. The speed command value and origin search speed must be set in advance in the Axis 1 Operating Output Memory Area before executing this sample program.

If the Axis 1 origin is not established within 10 seconds after the origin input signal is detected and the *Final Travel Distance to Return to Zero Point* positioning is performed, the Origin Search Timeout will occur and W305.02 will be turned ON for one cycle.

Sample Ladder Program



11-2-6 Positioning (Absolute Movement or Relative Movement)

Overview

This sample program sends a positioning command to a Servo Drive connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In addition, when executing ABSOLUTE MOVEMENT, establish the origin by performing an origin search before sending the position command.

In this example, positioning is performed on the Servo Drive registered as axis 1 using the ABSOLUTE MOVEMENT Bit or RELATIVE MOVEMENT Bit in the Axis Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Areas: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Areas: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Work Area (WR Area)

W201.00 to W201.03

These Work Area bits are used to show the progress of function execution and the execution status.

Holding Area (HR Area)

H1.00

This bit is used as a switch to indicate whether positioning is performed with ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

Timer Area

TIM0003

Used as a watchdog timer to monitor the positioning operation.

This sample program starts Axis 1 positioning when the Positioning execution condition goes ON.

The position command value must be set to the target position and the speed command value must be set to the target speed in the Axis Operating Output Memory Area before executing this sample program.

At this point, the ON/OFF status of HR1.00 determines whether the positioning is executed with RELATIVE MOVEMENT (HR1.00 OFF) or ABSOLUTE MOVEMENT (HR1.00 ON).

If axis 1 positioning is not completed within 10 seconds after completion of sending the positioning command, i.e., after pulse distribution is completed, a Positioning Timeout will occur and bit W201.03 will be turned ON for one cycle.

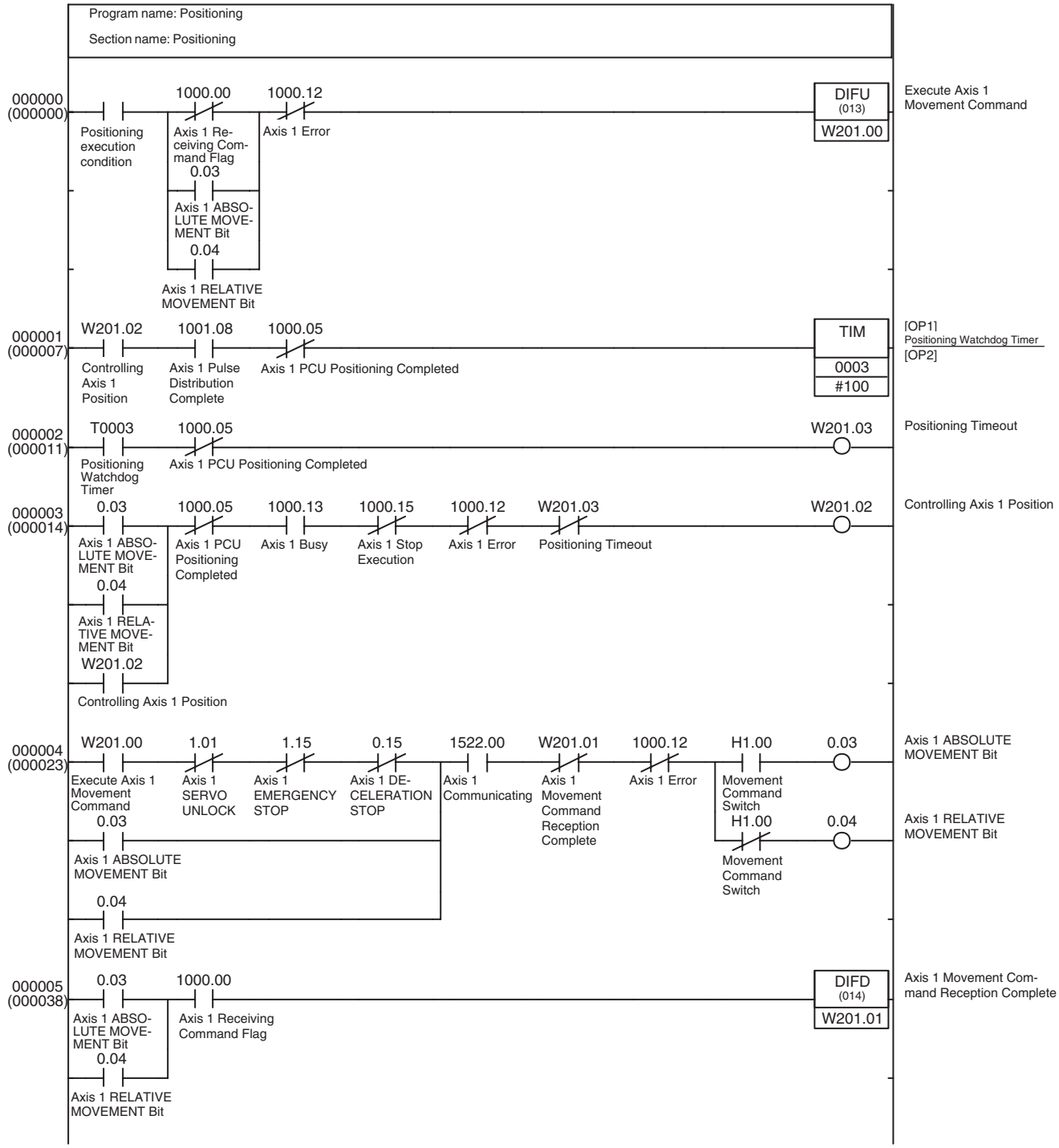
The target position can be changed during an Absolute Movement or Relative Movement positioning operation by setting a new position command value and turning ON the ABSOLUTE or RELATIVE MOVEMENT Bit. Torque limits can also be enabled/disabled during positioning by turning ON/OFF the forward and reverse rotation current limit bits in the Axis Operating Output Memory Area and turning ON the ABSOLUTE or RELATIVE MOVEMENT Bit.

This sample program allows the target position to be changed during an operation by turning the execution condition OFF and then ON again.

A Multistart Error will occur if a Movement command is sent while the PCU's Receiving Command Flag is already ON, so the Receiving Command Flag is ANDed with the Positioning execution condition (in the W201.00 output circuit). An OR circuit containing the ABSOLUTE MOVEMENT Bit and RELATIVE MOVEMENT Bit has been added so that the W201.00 is not output again when the Receiving Command Flag goes from ON to OFF.

The target speed can be changed sequentially during operation by overwriting the speed command value in the Axis Operating Output Memory Area.

Sample Ladder Program



11-2-7 Speed Control

Overview

This sample program performs speed control on a Servo Drive connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In this example, speed control is performed on the Servo Drive registered as axis 1 using the SPEED CONTROL Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Work Area (WR Area)

W202.00 to W202.02

These Work Area bits are used to show the progress of function execution and the execution status.

This sample program starts Axis 1 speed control when the Speed Control execution condition goes ON.

The speed command value in the Axis 1 Operating Output Memory Area must be set to the target speed in advance before executing this sample program.

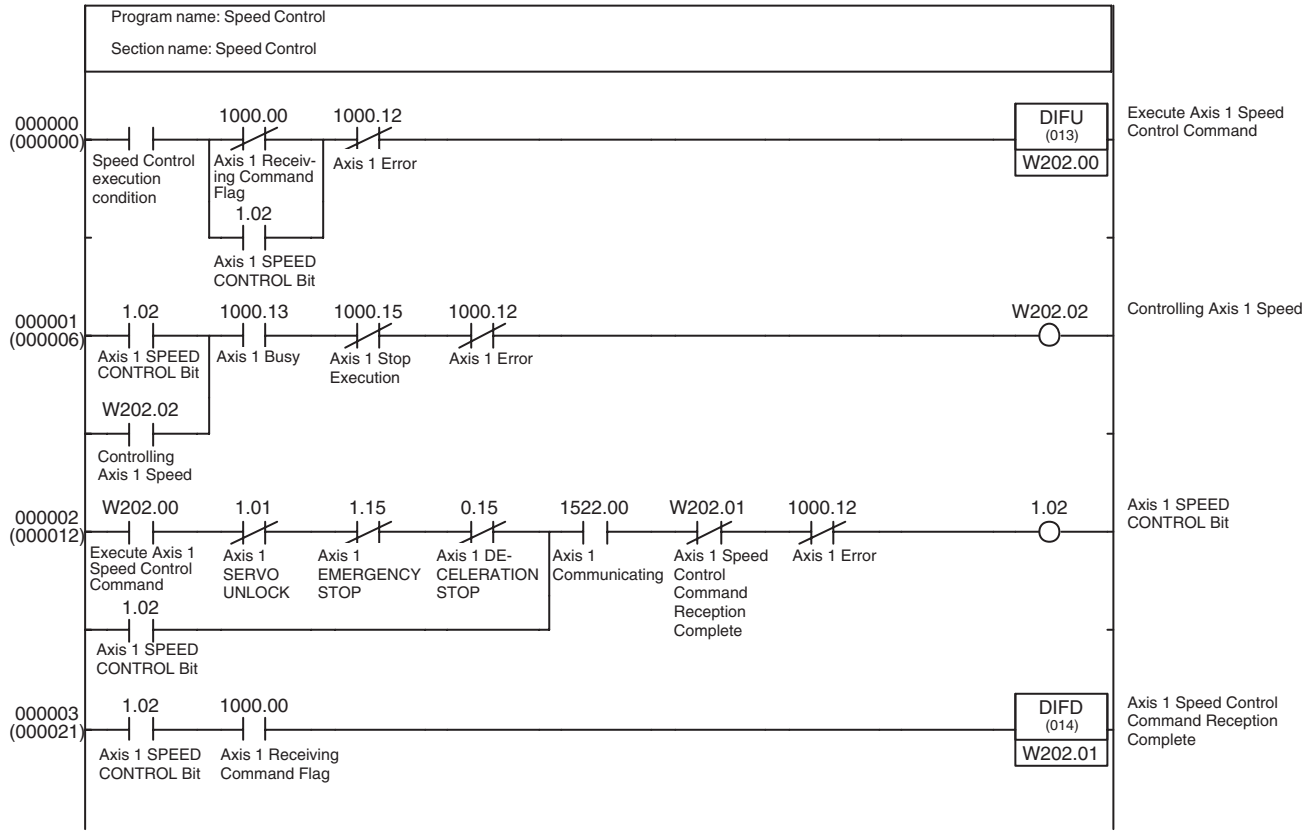
The target speed can be changed sequentially during operation by overwriting the speed command value for speed control in the Axis Operating Output Memory Area.

Torque limits can be enabled/disabled and the torque limits can be changed during operation by turning ON/OFF the forward and reverse rotation current limit bits and changing the option command values in the Axis Operating Output Memory Area and then turning ON the SPEED CONTROL Bit.

This sample program allows the speed control command to be sent again during an operation by turning the Speed Control execution condition OFF and then ON again.

A Multistart Error will occur if a Speed Control command is sent while the PCU's Receiving Command Flag is already ON, so the condition that the Receiving Command Flag is OFF is ANDed with the Speed Control execution condition (in the W202.00 output circuit). The Axis 1 SPEED CONTROL Bit has been added as an OR condition so that the W202.00 is not output again when the Receiving Command Flag goes from ON to OFF.

Sample Ladder Program



11-2-8 Torque Control

Overview

This sample program performs torque control on a Servo Drive connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In this example, torque control is performed on the Servo Drive registered as axis 1 using the TORQUE CONTROL Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

Work Area (WR Area)

W203.00 to W203.02

These Work Area bits are used to show the progress of function execution and the execution status.

This sample program starts Axis 1 torque control when the Torque Control execution condition goes ON.

The torque command value in the Axis 1 Operating Output Memory Area must be set to the desired output torque in advance before executing this sample program.

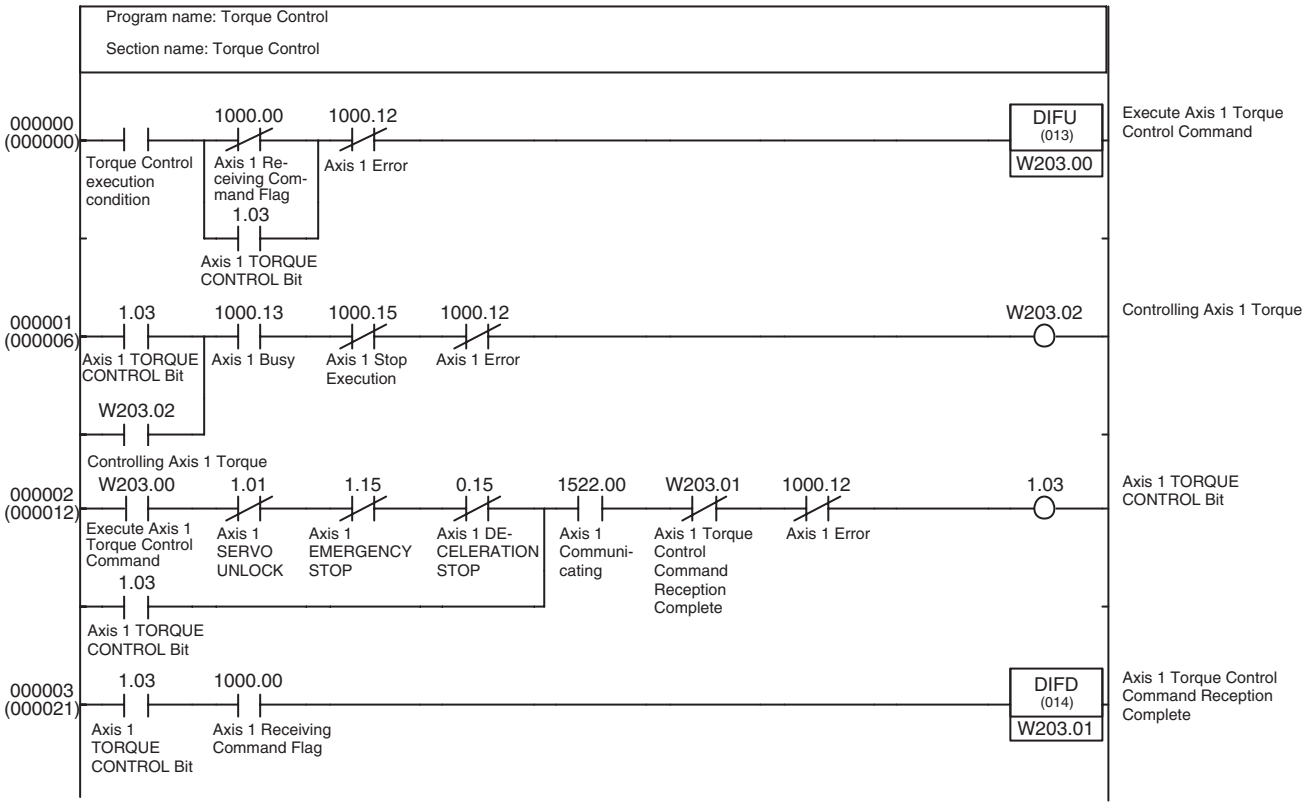
The torque control's output torque can be changed sequentially during operation by overwriting the torque command value in the Axis Operating Output Memory Area.

Torque limits can be enabled/disabled and the speed limit value can be changed during operation by turning ON/OFF the forward and reverse rotation current limit bits and changing the option command values in the Axis Operating Output Memory Area and then turning ON the TORQUE CONTROL Bit.

This sample program allows the TORQUE CONTROL command to be sent again during an operation by turning the Torque Control execution condition OFF and then ON again.

A Multistart Error will occur if a TORQUE CONTROL command is sent while the PCU's Receiving Command Flag is already ON, so include an AND of the Receiving Command Flag OFF in the execution condition for Torque Control execution (i.e. from the W203.00 output in the following example). The TORQUE CONTROL Bit has been added as an OR condition so that the W203.00 is not output again when the Receiving Command Flag goes from ON to OFF.

Sample Ladder Program



11-2-9 Deceleration Stop or Emergency Stop

Overview

This sample program performs a deceleration stop or emergency stop on a Servo Drive connected through MECHATROLINK communications. Execute this sample program only after starting MECHATROLINK communications with the servo locked (i.e., after establishing a connection).

In this example, a deceleration stop or emergency stop is performed on the Servo Drive registered as axis 1 using the DECELERATION STOP Bit or EMERGENCY STOP Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

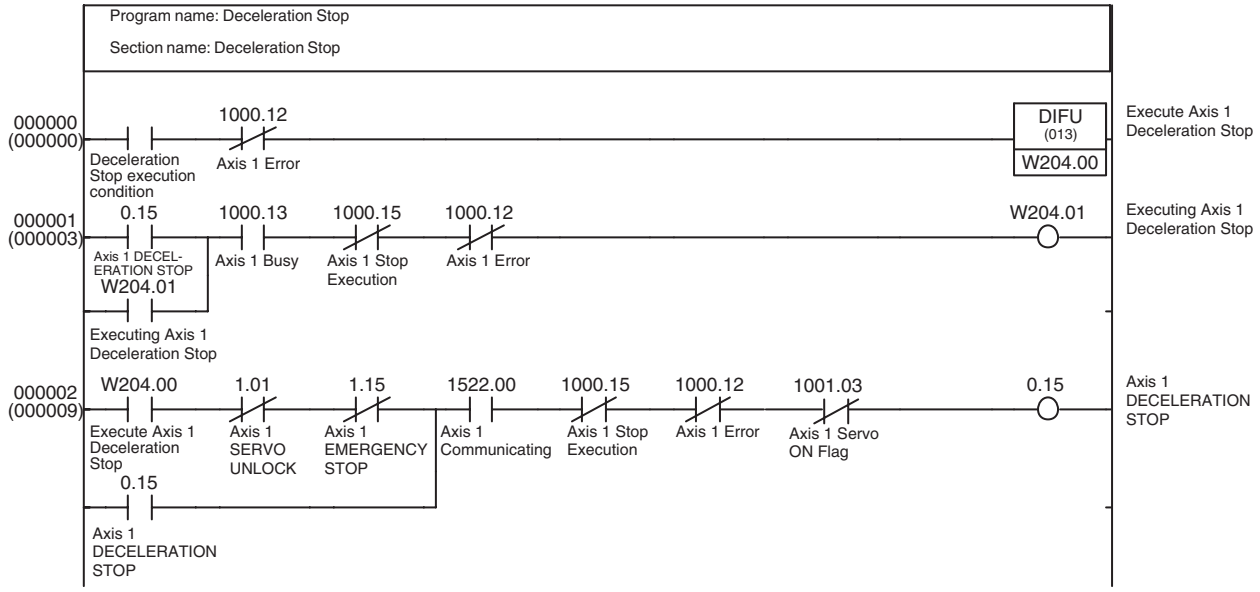
Work Area (WR Area)

Deceleration Stop: W204.00 and W204.01
Emergency Stop: W205.00 and W205.01

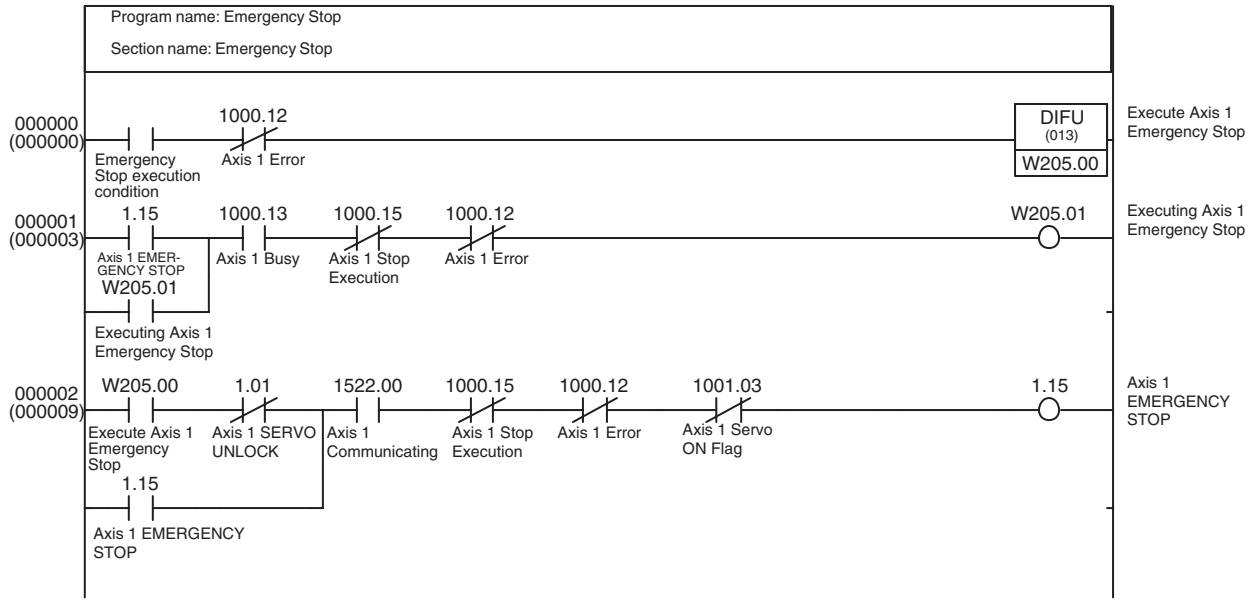
These Work Area bits are used to show the progress of function execution and the execution status.

This sample program executes a deceleration stop or emergency stop on Axis 1 when the Deceleration Stop or Emergency Stop execution condition goes ON.

Sample Ladder Program (Deceleration Stop)



Sample Ladder Program (Emergency Stop)



Note Deceleration and emergency stops are possible only when the Servo is locked. If the Servo is unlocked, these stop commands will be ignored. In the above programming example, the Servo ON Flag is inserted as an output condition so that DECELERATION STOP, EMERGENCY STOP, and work bits do not remain ON even if a deceleration stop or emergency stop is executed when the Servo is not locked.

11-2-10 Jogging

Overview

This sample program performs jogging with the Servo Drive connected via MECHATROLINK communications. MECHATROLINK communications start (i.e., a connection is established), and after executing SERVO LOCK, jogging is executed while the Servomotor is in a servo locked state.

In this programming example, jogging is executed for the Servo Drive registered at axis 1 when the Jog Bit turns ON in the Axis Operating Output Memory Area. The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory.

Work Area (WR Area)

W206.00 to W206.01

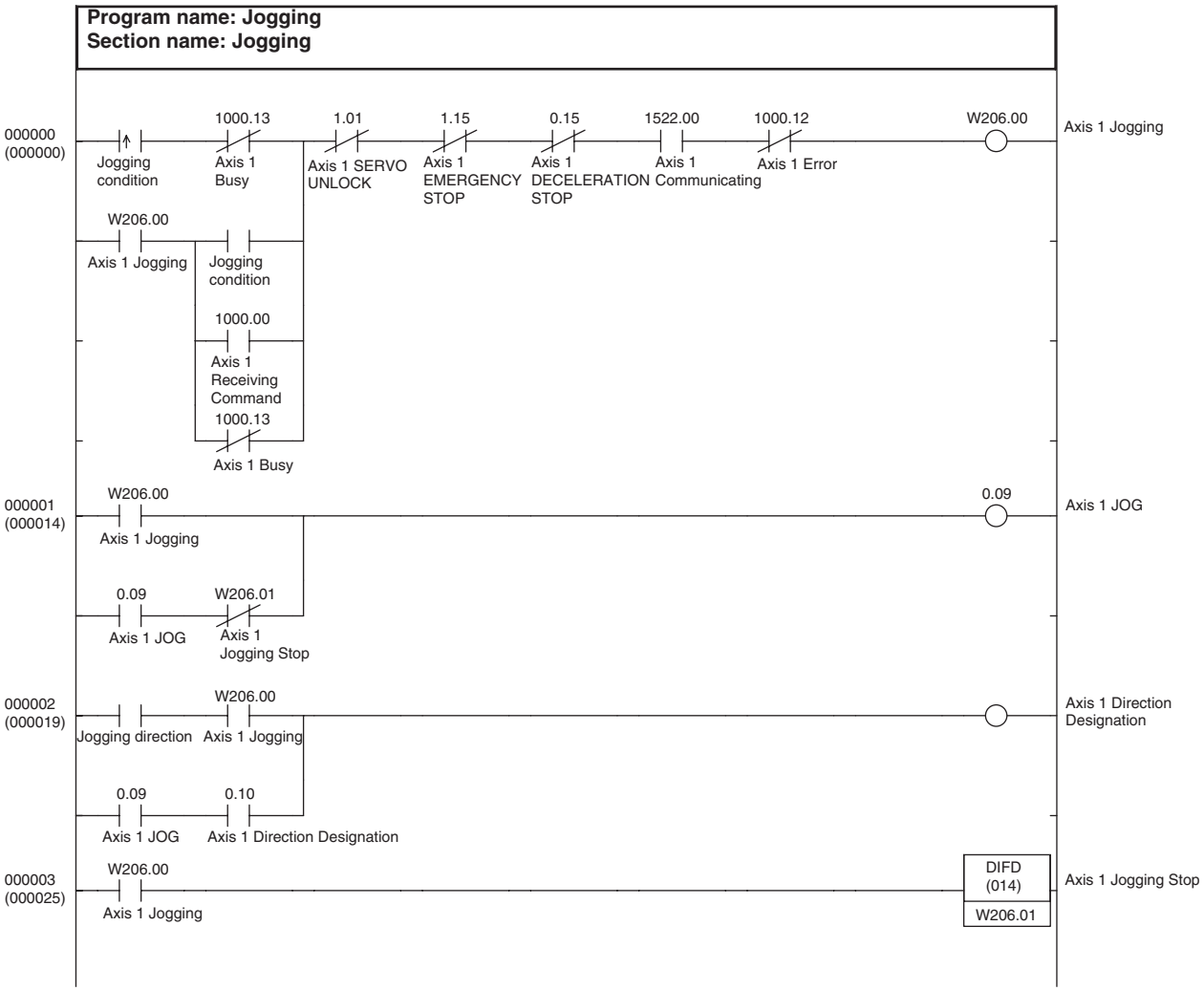
These Work Area bits are used to create the operation timing for function execution.

In this program example, jogging starts when the jogging condition turns ON, and stops when the jogging condition turns OFF. Jogging is performed in the forward direction when the jogging direction is OFF at the start of jogging. Jogging is performed in the reverse direction when the jogging direction is ON at the start of jogging.

When executing this programming example, the target speed must be set in the speed command value of the Axis 1 Operating Output Memory Area. The target speed for jogging can be changed successively during operation by writing the speed command value to the Axis Operating Output Memory Area.

In this programming example, application in combination with the PCU jogging (adjustment operation) Smart Active Parts Library provided in the OMRON NS-series Programmable Terminals has been considered and thus the program is constructed with self-holding bits for the Jog Bit and Direction Designation Bit in the Axis Operating Output Memory Area. Therefore, the command for the jogging condition is sent via the Work Area bit W206.00.
The output circuit of Work Area bit W206.00 is also provided with a self-holding circuit that operates according to the Receiving Command Flag and Busy Flag to enable the JOG command to be received correctly at the PCU.

Ladder Programming Example



11-3 Application Examples

This section shows sample application programs created by combining the basic sample programs introduced in the previous section.

To make the basic sample programs easier to understand, the basic sample programs reused in this section's application examples keep the same Work Area word and bit addresses that were allocated in the previous section.

11-3-1 Initial PCU Settings

Overview

This application combines the data-writing and data-saving functions from *11-2-1 Transferring PCU Parameters* with the communications function from *11-2-2 Starting and Stopping MECHATROLINK Communications* to make the Initial PCU Settings. The 80 words of parameter data (including unused words) must be preset in EM Area words E0_00000 to E0_00079 with the 40 words of Common Parameters and 40 words of Axis Parameters (20 words each for axes 1 and 2).

In this program, the initial PCU settings are made when H0.00 is OFF and the task switches from INI to RUN status. After the initial settings are made, the PCU is restarted. The transferred and saved parameters are enabled and H0.00 is turned ON (Set) at the same time so that the initial settings are not made again.

To make the initial settings again, reset H0.00 and execute the program again.

When H0.00 is reset, the Initial Task Execution Flag is used as the Write Data execution condition and the Unit Data Write End Flag (W300.05) is used as the Save Data execution condition. When the Save Data operation is completed (W302.05 ON), the Unit is restarted and H0.00 is turned ON.

MECHATROLINK communications will be controlled by the new Common Parameters in the PCU either after the Unit restart at the end of initial settings if H0.00 is OFF, or after starting the program (task) if H0.00 is ON.

This sample program uses the following parts of the CPU Unit's I/O memory.

CPU Bus Unit Area

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

EM Area bank 0

E0_00000 to E0_00079

These 80 EM words are used to transfer to the PCU the 40 words of Common Parameters and 40 words of Axis Parameters (20 words each for axes 1 and 2).

Work Area (WR Area)

Writing Data:	W300.00 to W300.06
Saving Data:	W302.00 to W302.06
Starting Communications:	W303.00 to W303.04
Restarting the Unit:	W304.00 to W304.03

These Work Area bits are used to show the progress of function execution and the execution status.

The following parts of I/O memory are used in the combined program example.

Holding Area (HR Area)

H0.00

Used as a switch to enable/disable the initial PCU settings function.

I/O Bits

Restart Communications:400.00
Stop Communications: 400.01

When the corresponding I/O bit goes ON, stopped MECHATROLINK communications are restarted or established MECHATROLINK communications are stopped.

This sample program writes the following Common Parameters and Axis Parameters (initial settings).

Common Parameters

Scan List: Registers Servo Drives to axes 1 and 2 (station numbers 1 and 2).

Beginning word of Axis Operating Output Memory Area: CIO 0000

Beginning word of Axis Operating Input Memory Area: CIO 1000

MECHATROLINK communications settings:
Transfer cycle: 1 ms
Communications cycle: × 2 (1 ms × 2 = 2 ms)
Number of communications retries: 0 (1 retry)
C2 Master connection: 0 (No C2 Master)

Axis Parameters for Axes 1 and 2 (Shared by both Axes.)

Origin input signal selection: 00 (Phase Z)

Interrupt input signal selection: 01 (External latch signal 1 input)

Origin search direction: 0 (Forward)

Origin search operation mode: 1 (Reversal mode 2)

Encoder type: 0 (Incremental encoder)

The following parameter settings must be written in advance to the CPU Unit's EM Area words E0_00000 to E0_00079.

EM word	Set value	Item	Details
E0_00000	00B0 hex	Common Parameters Axis Operating Output Memory Area designation	Sets the beginning word of the Axis Operating Output Memory Areas to CIO 0000. Axis 1 output words: CIO 0000 to CIO 0024 Axis 2 output words: CIO 0025 to CIO 0049
E0_00001	0000 hex	Common Parameters Beginning word of Axis Operating Output Memory Areas	
E0_00002	00B0 hex	Common Parameters Axis Operating Input Memory Area designation	Sets the beginning word of the Axis Operating Input Memory Areas to CIO 1000. Axis 1 input words: CIO 1000 to CIO 1024 Axis 2 input words: CIO 1025 to CIO 1049
E0_00003	03E8 hex	Common Parameters Beginning word of Axis Operating Input Memory Areas	
E0_00004	4040 hex	Common Parameters Scan list setting (axes 1 and 2)	Allocates axes 1 and 2 to the Servo Drive.
E0_00005 to E0_00011	0000 hex	Common Parameters Scan list setting (axes 3 to 16)	
E0_00012 to E0_00029	0000 hex	Not used.	This part of the Common Parameters is unused. Set all words to 0000 hex.

EM word	Set value	Item	Details
E0_00030	0102 hex	Common Parameters MECHATROLINK communications settings Transfer cycle and communications cycle	Transfer cycle: 01 (1 ms) Communications cycle: 02 (×2)
E0_00031	0000 hex	Common Parameters MECHATROLINK communications settings Number of communications retries and C2 Master connection	Number of communications retries: 0 (1 retry) C2 Master connection: 0 (No C2 Master)
E0_00032 to E0_00039	0000 hex	Not used.	This part of the Common Parameters is unused. Set all words to 0000 hex.
E0_00040	0001 hex	Axis 1 Parameters Origin input signal selection and Interrupt input signal selection	Origin input signal selection: 00 (Phase Z) Interrupt input signal selection: 01 (External latch signal 1 input)
E0_00041	0010 hex	Axis 1 Parameters Origin search direction and Origin search operation	Origin search direction: 0 (Forward) Origin search operation mode: 1 (Reversal mode 2)
E0_00042	0000 hex	Axis 1 Parameters Encoder type	Encoder type: 0 (Incremental encoder)
E0_00043 to E0_00059	0000 hex	Not used.	This part of the Common Parameters is unused. Set all words to 0000 hex.
E0_00060	0001 hex	Axis 2 Parameters Origin input signal selection and Interrupt input signal selection	Origin input signal selection: 00 (Phase Z) Interrupt input signal selection: 01 (External latch signal 1 input)
E0_00061	0010 hex	Axis 2 Parameters Origin search direction and Origin search operation	Origin search direction: 0 (Forward) Origin search operation mode: 1 (Reversal mode 2)
E0_00062	0000 hex	Axis 2 Parameters Encoder type	Encoder type: 0 (Incremental encoder)
E0_00063 to E0_00079	0000 hex	Not used.	This part of the Common Parameters is unused. Set all words to 0000 hex.

The PCU does not use regions E0_00012 to E0_00029, E0_00032 to E0_00039, E0_00043 to E0_00059, and E0_00063 to E0_00079 in the Common Parameter Area and Axis Parameter Areas.

These unused areas are reserved because this program transfers all 80 words (40 words of Common Parameters and 40 words of Axis Parameters for axes 1 and 2) to the PCU's internal addresses at once.

Set all words in the unused addresses to 0000 hex.

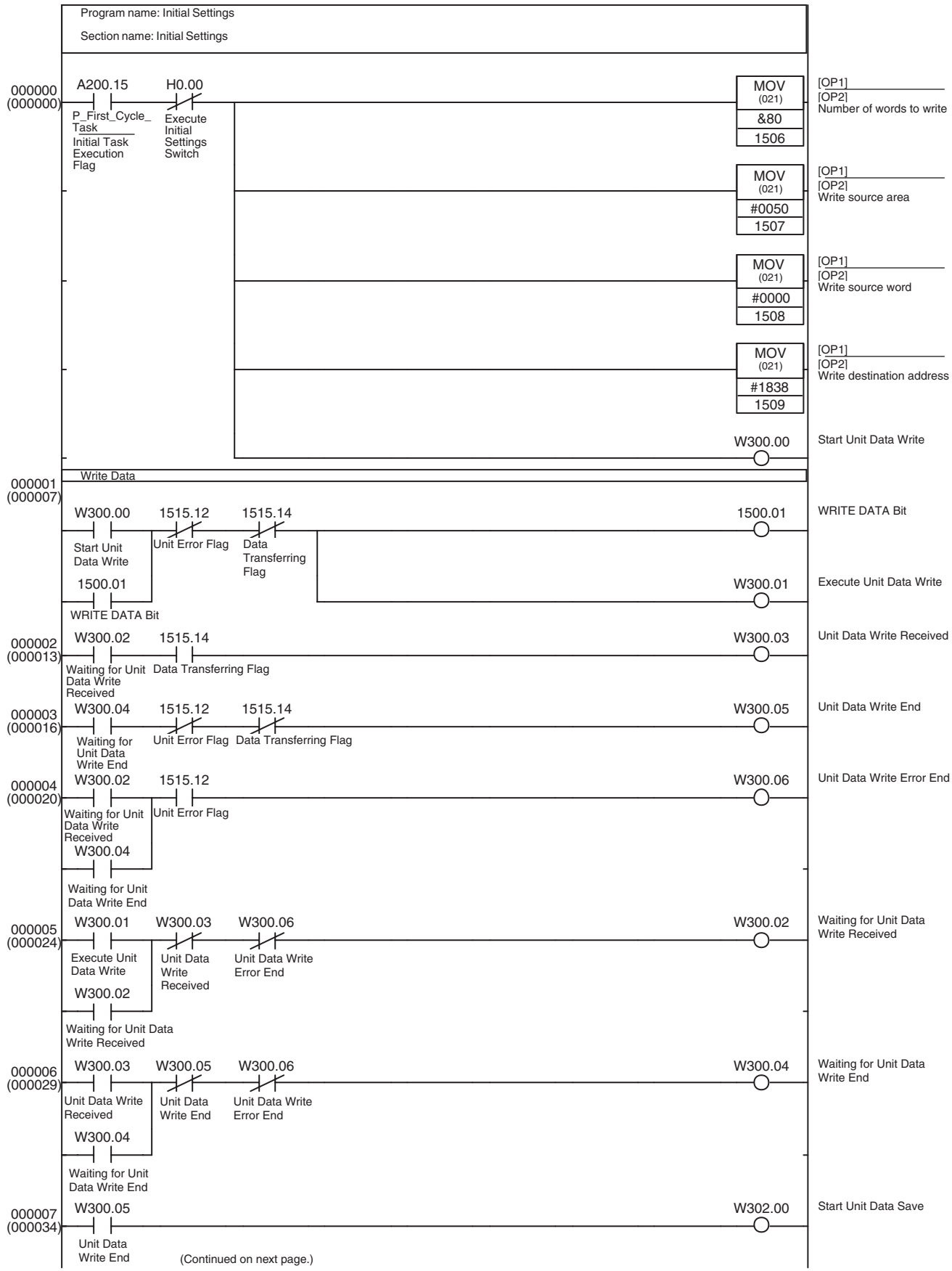
When Axis Parameters are being transferred for axis 3 or higher axes, prepare the parameter settings in 20-word regions for each axis (starting from E0_00080) with the same data configuration as axis 1. This sample program can be used to make the initial settings for multi-axis operation by changing the number of write words to 40 words (Common Parameters) + 20 words × Number of axes (Axis Parameters).

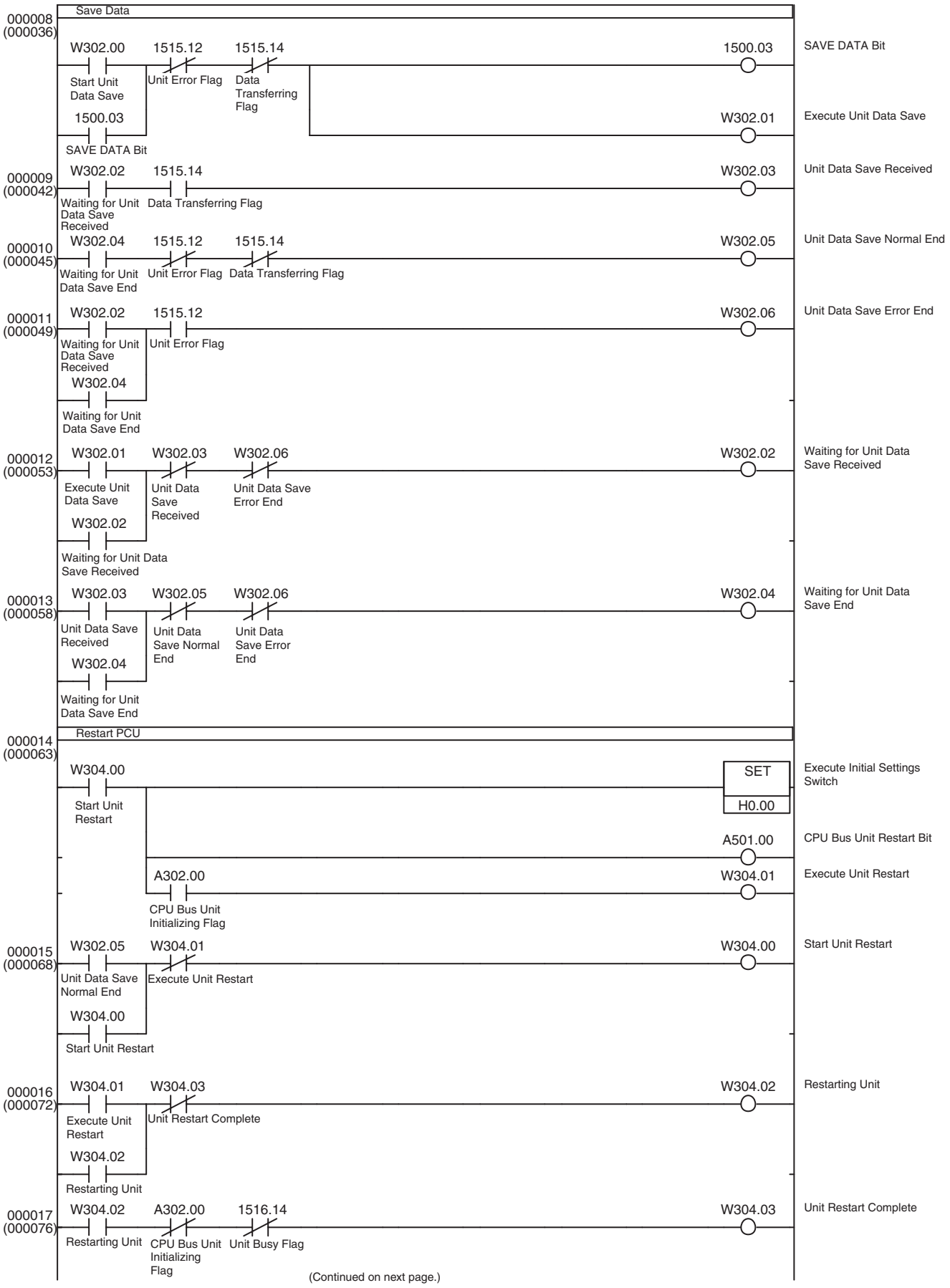
Conversely, when only axis 1 is being used, set the number of write words to 60 words and prepare only EM words E0_00000 to E0_00059 from the table above. (Change the scan list in the Common Parameters so that only axis 1 is used.)

When the initial PCU settings have been made, W304.03 is turned ON for one cycle.

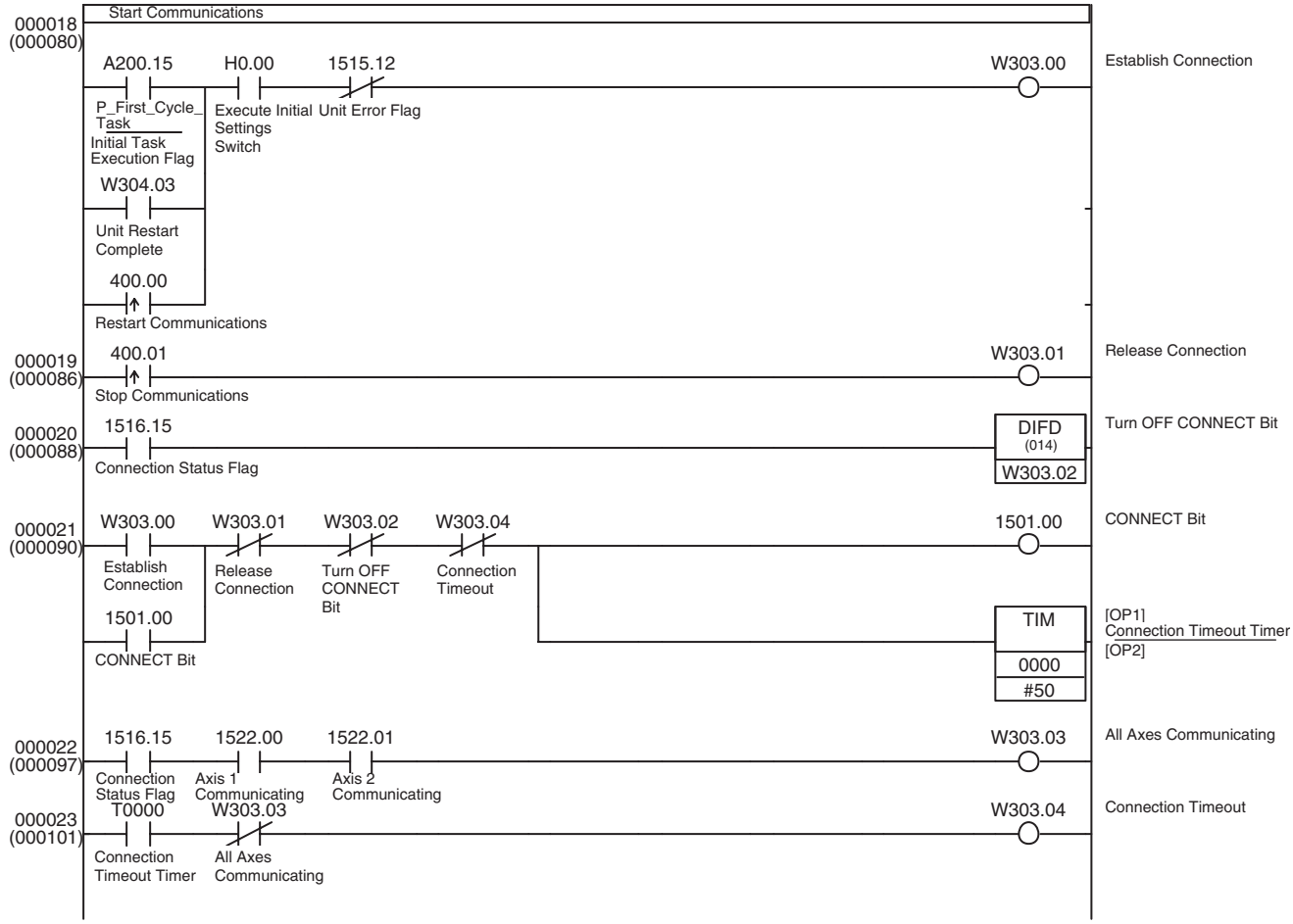
Also, W303.03 will be turned ON when MECHATROLINK communications have started and all axes (axes 1 and 2 in this case) are communicating normally.

Sample Ladder Program





(Continued on next page.)



11-3-2 Servo Parameter Backup

Overview

This application incorporates the Servo Parameter transfer functions from *11-2-3 Transferring Servo Parameters* to transfer (write, read, or save) all of the Servo Drive's Servo Parameters at one time with the CPU Unit's EM Area.

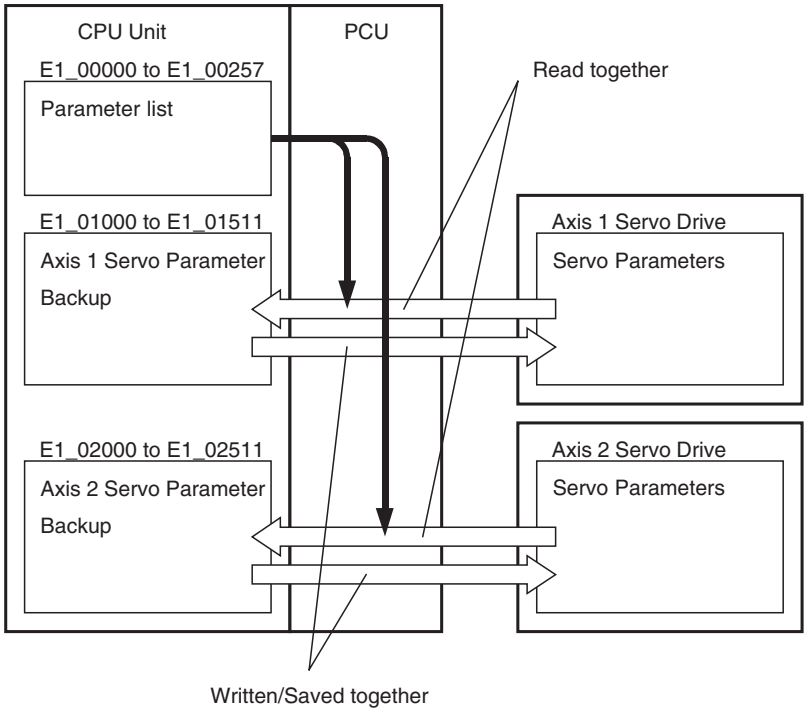
This application example is normally executed after the initial PCU settings application shown in *11-3-1 Initial PCU Settings*.

The Servo Parameters to be transferred are set in the CPU Unit's EM Area as a parameter list.

When reading Servo Parameters, the parameter data read from the Servo Drive is stored in the specified EM words based on this parameter list.

When writing/saving Servo Parameters, the parameter data is stored in the EM Area in the prescribed format and written to the Servo Drives in order.

In this program example, the Servo Drives connected as axes 1 and 2 are both W-series Servo Drives and the same Servo Parameter list is transferred to both.



The Axis Operating Output/Input Memory Areas for axes 1 and 2 are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

(Axis 2 Operating Output Memory Area: CIO 0025 to CIO 0049)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

(Axis 2 Operating Input Memory Area: CIO 1025 to CIO 1049)

This sample program uses the following parts of the CPU Unit's I/O memory.

CPU Bus Unit Area

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

Data Memory Area (DM Area)

Axis 1 Servo Parameter words: D10500 to D10503
Axis 2 Servo Parameter words: D10600 to D10603

These words are used to store the data required for a single Servo Parameter transfer, including the Servo Parameter number, parameter size, and transfer data (2 words).

EM Area bank 1

Servo Parameter list: E1_00000 to E1_00257
Axis 1 Servo Parameter words: E1_01000 to E1_01511
Axis 2 Servo Parameter words: E1_02000 to E1_02511

When the Servo Parameters are being read, these EM words are used to store the parameter list read from the Servo Drive. These words are also used to store the Servo Parameters that were read and set the Servo Parameters that will be written.

Index Registers (IR)

IR6 to IR8

The Index Registers are used to reference the Servo Parameter list and reference the EM Area addresses that contain the parameter data being read/written.

Work Area (WR Area)

Write Axis 1 Servo Parameters: W400.00 to W400.06
Read Axis 1 Servo Parameters: W401.00 to W401.06
Save Axis 1 Servo Parameters: W402.00 to W402.06
Write Axis 2 Servo Parameters: W410.00 to W410.06
Read Axis 2 Servo Parameters: W411.00 to W411.06
Save Axis 2 Servo Parameters: W412.00 to W412.06
Batch transfer sequence stepping: W500.00 to W500.10

These Work Area bits are used to show the progress of function execution and the execution status.

Holding Area (HR Area)

Axis 1 Transfer Function Selection: H10.00 to H10.02
Axis 2 Transfer Function Selection: H11.00 to H11.02

These bits are used to select the Servo Parameter transfer function for each axis.

The following table shows how the status of bits H10.00 to H10.02 and H11.00 to H11.02 specify the Servo Parameter transfer function in this sample program.

Transfer function	Axis 1			Axis 2		
	H10.00	H10.01	H10.02	H11.00	H11.01	H11.02
Write Servo Parameter	1	0	0	1	0	0
Read Servo Parameter	0	1	0	0	1	0
Save Servo Parameter	0	0	1	0	0	1

A different transfer function can be selected for each axis and executed for 2 axes simultaneously.

Different transfer functions cannot be performed at the same time on a single axis. If bits 00 to 02 are all OFF or more than one bit is ON, the transfer function will not be executed for that axis.

Also, when executing this sample program, always transfer the Servo Parameters for 2 axes.

CIO 0510.00 is used as the Servo Parameter Batch Transfer Start Switch.

Parameter List

In this program, the parameter list for the Read Servo Parameters function is stored in the CPU Unit's EM Area as follows.

The beginning words of the parameter list specify the parameter number and parameter size of each parameter.

+0: Parameter number (hex)
+1: Parameter size

The parameter number and size are specified in order for all of the parameters being transferred.

At the end of the parameter list, the parameter size is set to 0000 hex.

The following table shows a setting example for the parameter list in this program.

The Servo Parameters listed here are for an OMRON W-series Servo Drive with a JUSP-NS115 MECHATROLINK-II Application Module mounted. All 256 parameter numbers and parameter sizes shown in the table in *4-5 Servo Parameter Area* are included even if the parameters are not being used.

When the two-word end code (0000 0000) at the end of the parameter list is included, a total of 256 words (including unused words) are used, from E1_00000 to E1_00257.

Word	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
E1_00000	0000	0002	0001	0002	0002	0002	0003	0002	0004	0002
E1_00010	0005	0002	0100	0002	0101	0002	0002	0002	0103	0002
E1_00020	0104	0002	0105	0002	0106	0002	0107	0002	0108	0002
E1_00030	0109	0002	010A	0002	010B	0002	010C	0002	010D	0002
E1_00040	010E	0002	010F	0002	0110	0002	0111	0002	0112	0002
E1_00050	0113	0002	0114	0002	0115	0002	0116	0002	0117	0002
E1_00060	0118	0002	0119	0002	0120	0002	0121	0002	0122	0002
E1_00070	0123	0002	0124	0002	0125	0002	0200	0002	0201	0002
E1_00080	0202	0002	0203	0002	0204	0002	0205	0002	0206	0002
E1_00090	0207	0002	0208	0002	0212	0002	0217	0002	0218	0002
E1_00100	0300	0002	0301	0002	0302	0002	0303	0002	0304	0002
E1_00110	0305	0002	0306	0002	0307	0002	0308	0002	0309	0002
E1_00120	0400	0002	0401	0002	0402	0002	0403	0002	0404	0002
E1_00130	0405	0002	0406	0002	0407	0002	0408	0002	0409	0002
E1_00140	040A	0002	040B	0002	040C	0002	0500	0002	0501	0002
E1_00150	0502	0002	0503	0002	0504	0002	0505	0002	0506	0002
E1_00160	0507	0002	0508	0002	0509	0002	050A	0002	050B	0002
E1_00170	050C	0002	050D	0002	050E	0002	050F	0002	0510	0002
E1_00180	0511	0002	0512	0002	0513	0002	051A	0002	051B	0002
E1_00190	051C	0002	051E	0002	0600	0002	0601	0002	0800	0002
E1_00200	0801	0002	0802	0002	0803	0002	0804	0004	0806	0004
E1_00210	0808	0004	080A	0002	080B	0002	080C	0002	080D	0002
E1_00220	080E	0002	080F	0002	0810	0002	0811	0002	0812	0002
E1_00230	0813	0002	0814	0004	0816	0002	0817	0002	0818	0002
E1_00240	0819	0004	081B	0002	081C	0002	081D	0002	081E	0002
E1_00250	081F	0002	0820	0004	0822	0004	0000	0000	0000	0000

Read/Write Parameter Format

This program stores the Servo Parameters with the following format (read according to the parameter list above) in the specified part of the EM Area.

The parameter number, parameter size, and set value of each parameter are stored in four-word sets.

+0: Parameter number (hex)
+1: Parameter size
+2: Servo Parameter set value (rightmost word)
+3: Servo Parameter set value (leftmost word)

These four-word sets are stored in the order that the parameters appear in the parameter list.

When the parameter size is 2 bytes (0002 hex), the leftmost word of the set value in "+3: Servo Parameter set value" will be set to 0000 hex.

Example: First Part of Default Settings Read from an OMRON W-series Servo Drive

Word	+0	+1	+2	+3	+4	+5	+6	+7
E1_01000	0000	0002	0010	0000	0001	0002	1002	0000
E1_01008	0002	0002	0000	0000	0003	0002	0002	0000
E1_01016	0004	0002	0200	0000	0005	0002	0000	0000
E1_01024	0100	0002	0050	0000	0101	0002	07D0	0000
E1_01032	0102	0002	0028	0000	0103	0002	012C	0000
E1_01040	0104	0002	0050	0000	0105	0002	07D0	0000
E1_01048	0106	0002	0028	0000	0107	0002	0000	0000
E1_01056	0108	0002	0007	0000	0109	0002	0000	0000
E1_01064	010A	0002	0000	0000	010B	0002	0004	0000
:								

Note All of the data is expressed in hexadecimal.
For example, the data in E1_01024 to E1_01027 indicates parameter Pn100, a parameter size of 2 bytes, and a set value of 0050 hex (80 decimal).

This data format is also used in the sample program when writing or saving data from the CPU Unit's EM Area to the Servo Drive. (The parameter size at the end of the transfer data is 0000 hex, which is the end code.)

Consequently, this program can be used to read the Servo Parameters to the CPU Unit's EM Area to back up the Servo Parameters and those Servo Parameters can be transferred to a new Servo Drive if it is necessary to replace the Servo Drive in the future.

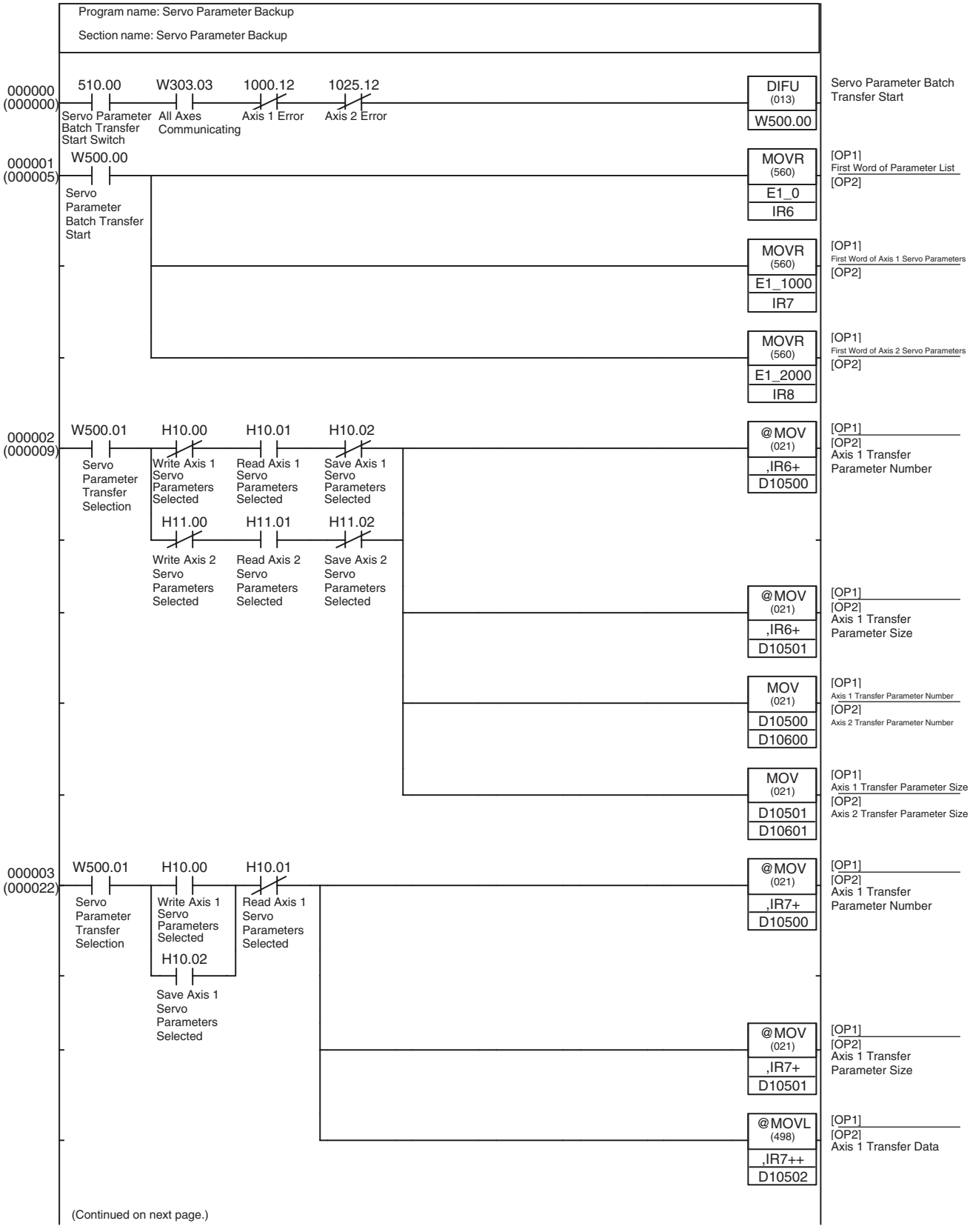
This sample program will start transferring the Servo Parameters when the Servo Parameter Batch Transfer Bit (CIO 510.00) is ON and W303.03 has been turned ON (indicating that axes 1 and 2 are both communicating normally) by the application example shown in *11-3-1 Initial PCU Settings*.

When this program is completed (Servo Parameter Transfer Complete), W500.05 is turned ON for one cycle. If an error occurs while the Servo Parameters are being transferred (Error Flag ON), the transfer will be cancelled at that point and W500.10 will be turned ON for one cycle.

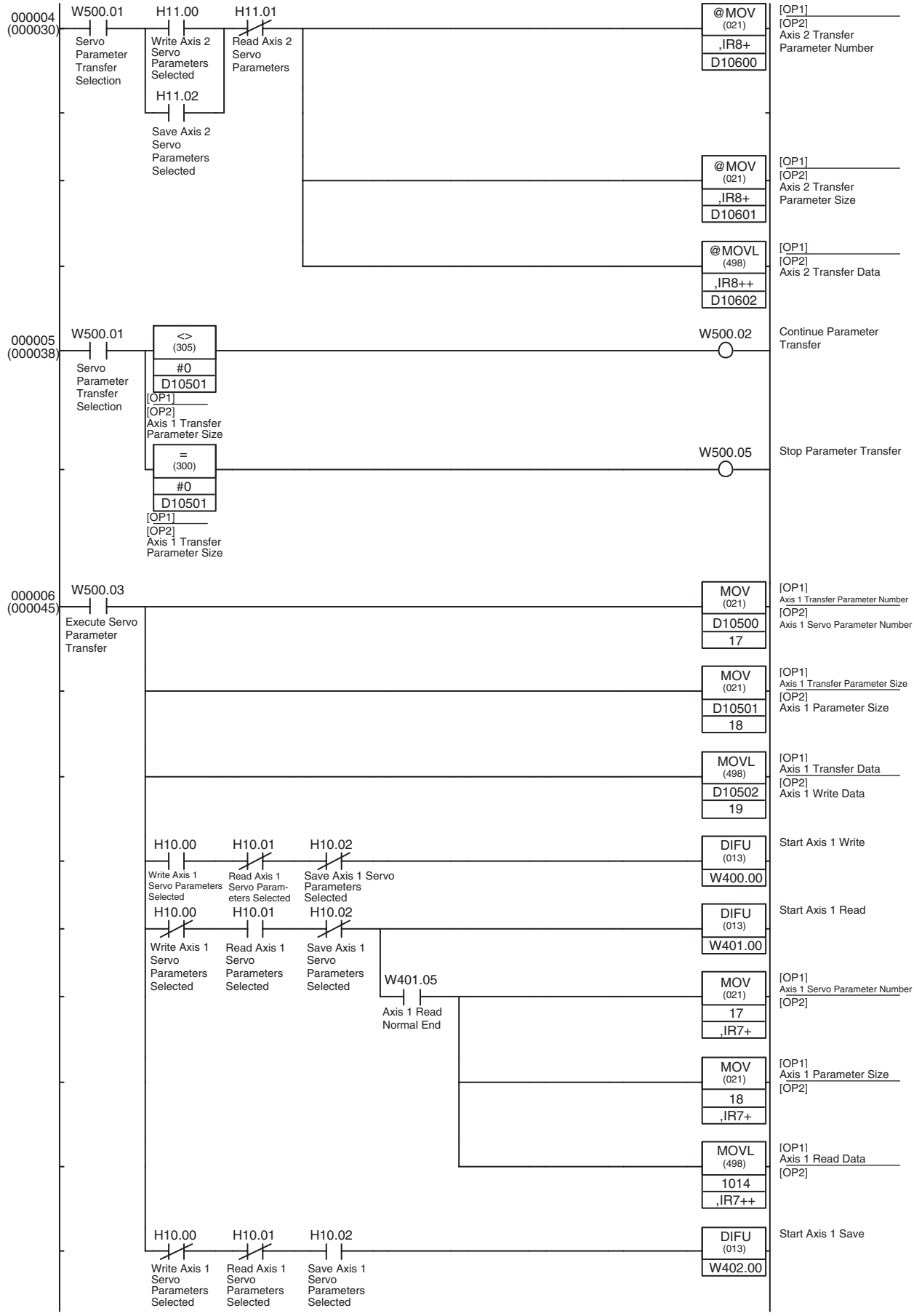
Sample Ladder Program

The Write Servo Parameters, Read Servo Parameters, and Save Servo Parameters functions for axis 1 (program steps 000016 to 000033) are the same as the functions described in *11-2-3 Transferring Servo Parameters*.

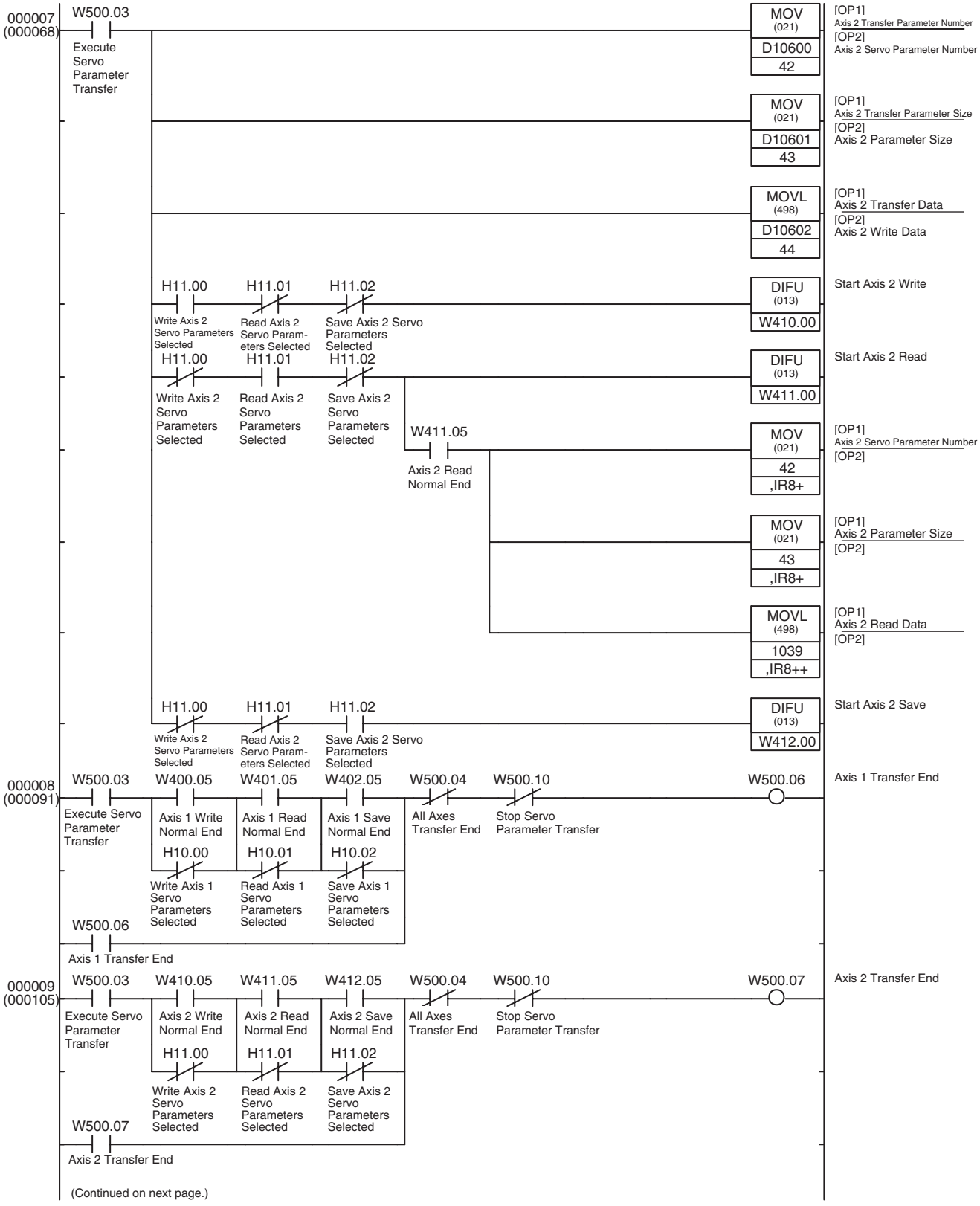
The functions for axis 2 (program steps 000034 to 000051) are the same as the functions for axis 1, except for the different I/O words. To prevent duplications, be sure to change the axis 1 output words (CIO 0000 to CIO 0024) to the corresponding axis 2 output words (CIO 0025 to CIO 0049) and change the axis 1 input words (CIO 1000 to CIO 1024) to the corresponding axis 2 input words (CIO 1025 to CIO 1049).



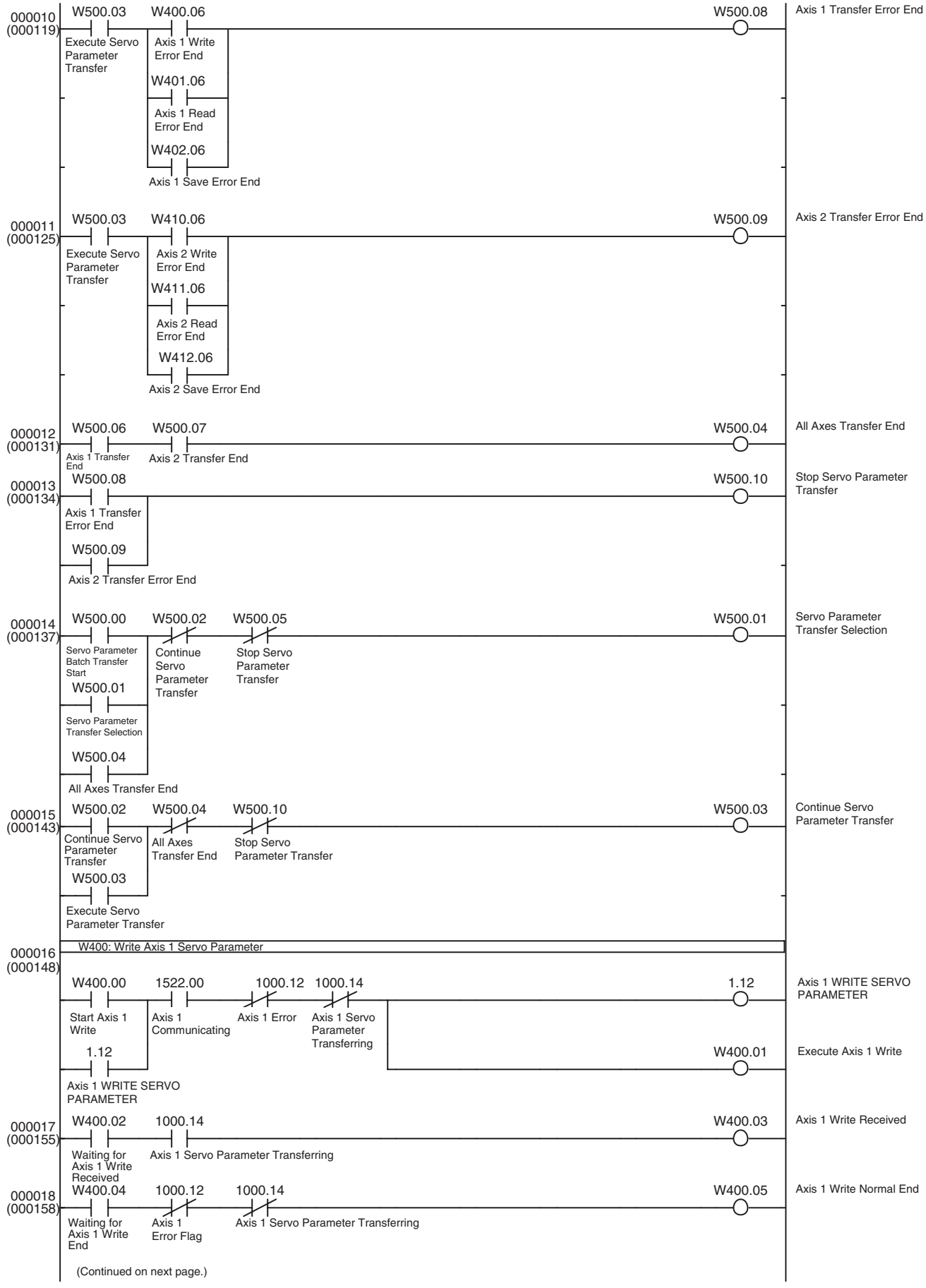
(Continued on next page.)

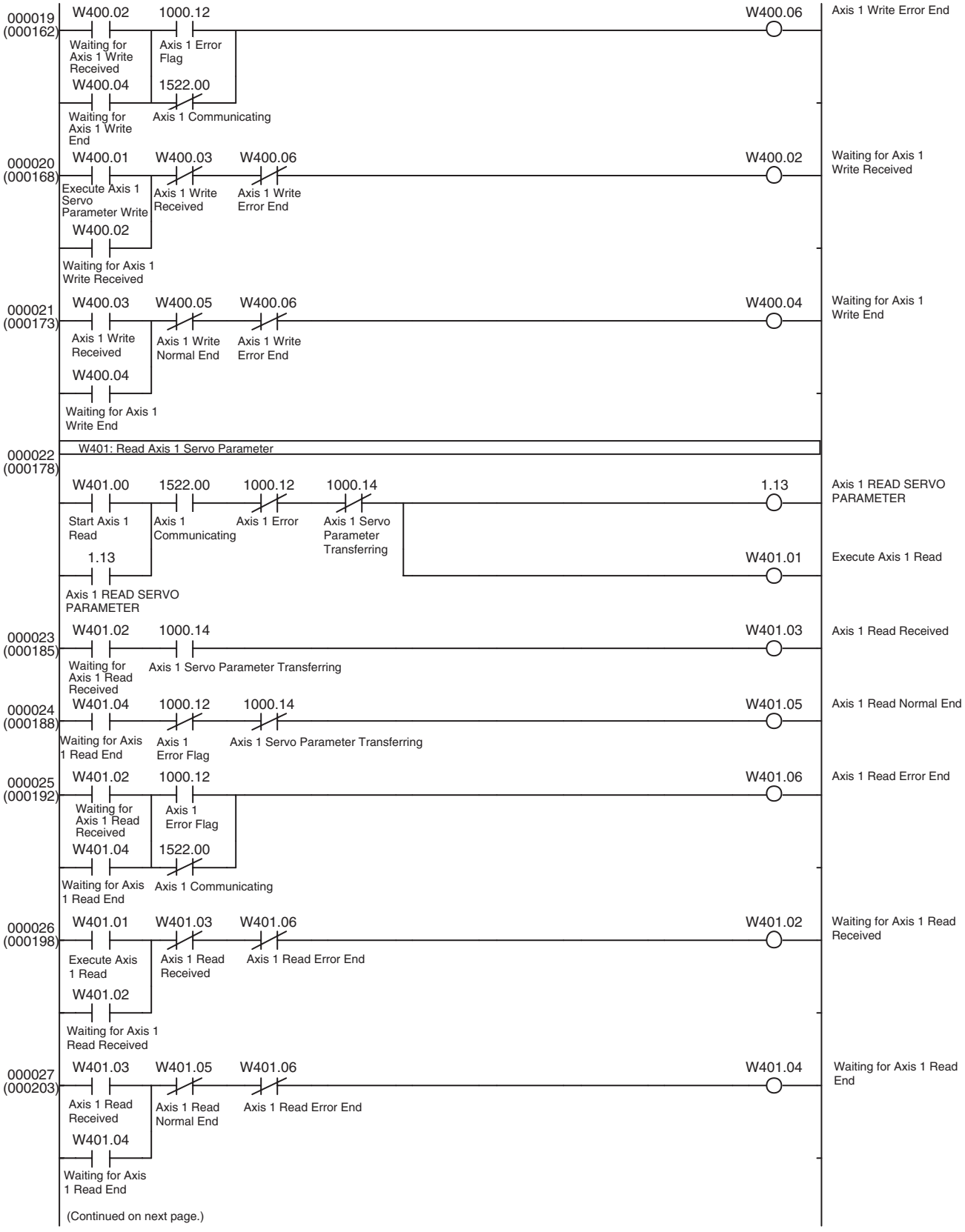


(Continued on next page.)



(Continued on next page.)


000010
(000119)
W500.03
Execute Servo Parameter Transfer
W400.06
Axis 1 Write Error End
W401.06
Axis 1 Read Error End
W402.06
Axis 1 Save Error End
W500.08
Axis 1 Transfer Error End
000011
(000125)
W500.03
Execute Servo Parameter Transfer
W410.06
Axis 2 Write Error End
W411.06
Axis 2 Read Error End
W412.06
Axis 2 Save Error End
W500.09
Axis 2 Transfer Error End
000012
(000131)
W500.06
Axis 1 Transfer End
W500.07
Axis 2 Transfer End
W500.04
All Axes Transfer End
000013
(000134)
W500.08
Axis 1 Transfer Error End
W500.09
Axis 2 Transfer Error End
W500.10
Stop Servo Parameter Transfer
000014
(000137)
W500.00
Servo Parameter Batch Transfer Start
W500.01
Servo Parameter Transfer Selection
W500.04
All Axes Transfer End
W500.02
Continue Servo Parameter Transfer
W500.05
Stop Servo Parameter Transfer
W500.01
Servo Parameter Transfer Selection
000015
(000143)
W500.02
Continue Servo Parameter Transfer
W500.03
Execute Servo Parameter Transfer
W500.04
All Axes Transfer End
W500.10
Stop Servo Parameter Transfer
W500.03
Continue Servo Parameter Transfer
000016
(000148)
W400: Write Axis 1 Servo Parameter
W400.00
Start Axis 1 Write
1.12
Axis 1 WRITE SERVO PARAMETER
1522.00
Axis 1 Communicating
1000.12
Axis 1 Error
1000.14
Axis 1 Servo Parameter Transferring
1.12
Axis 1 WRITE SERVO PARAMETER
W400.01
Execute Axis 1 Write
000017
(000155)
W400.02
Waiting for Axis 1 Write Received
1000.14
Axis 1 Servo Parameter Transferring
W400.03
Axis 1 Write Received
000018
(000158)
W400.04
Waiting for Axis 1 Write End
1000.12
Axis 1 Error Flag
1000.14
Axis 1 Servo Parameter Transferring
W400.05
Axis 1 Write Normal End
(Continued on next page.)



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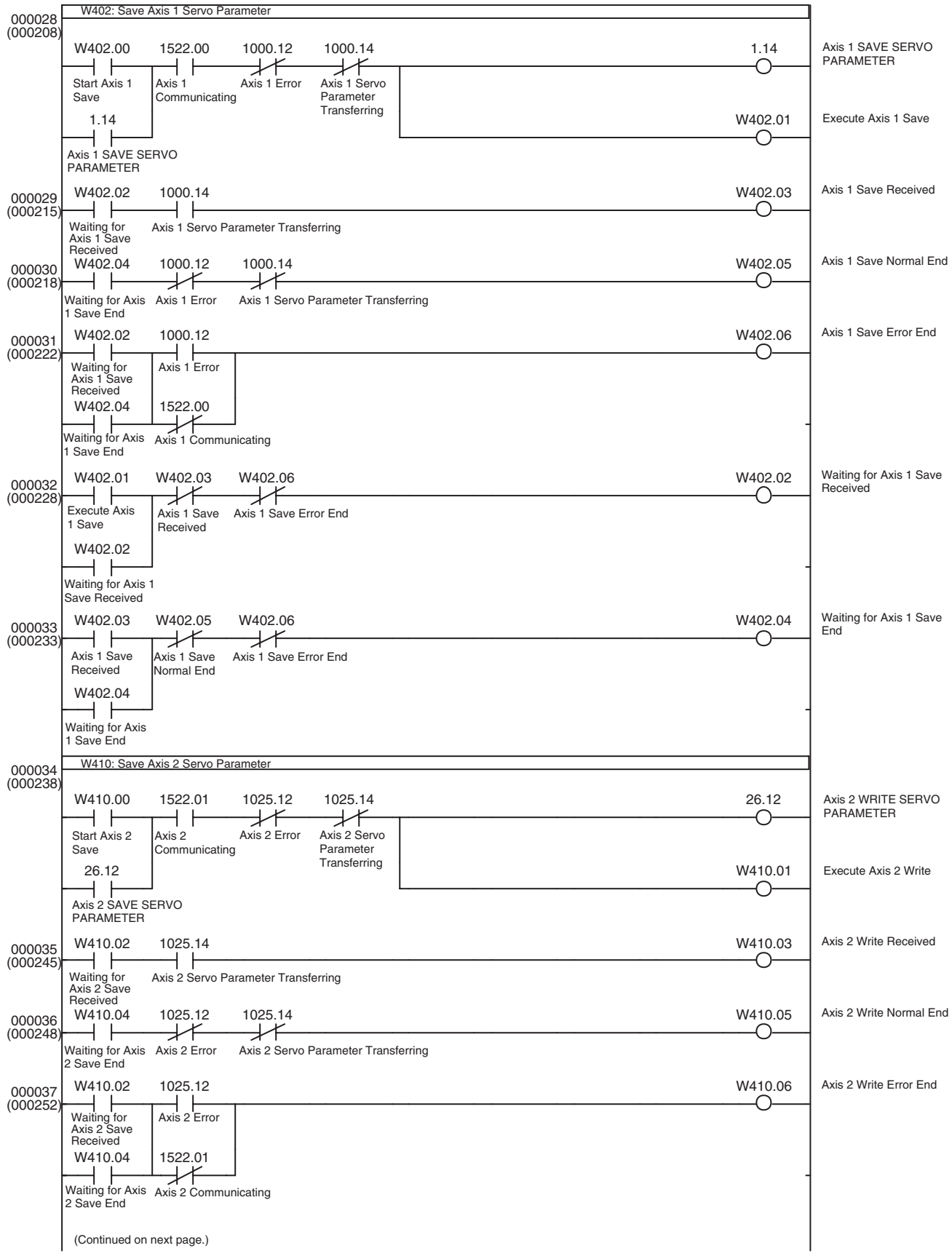
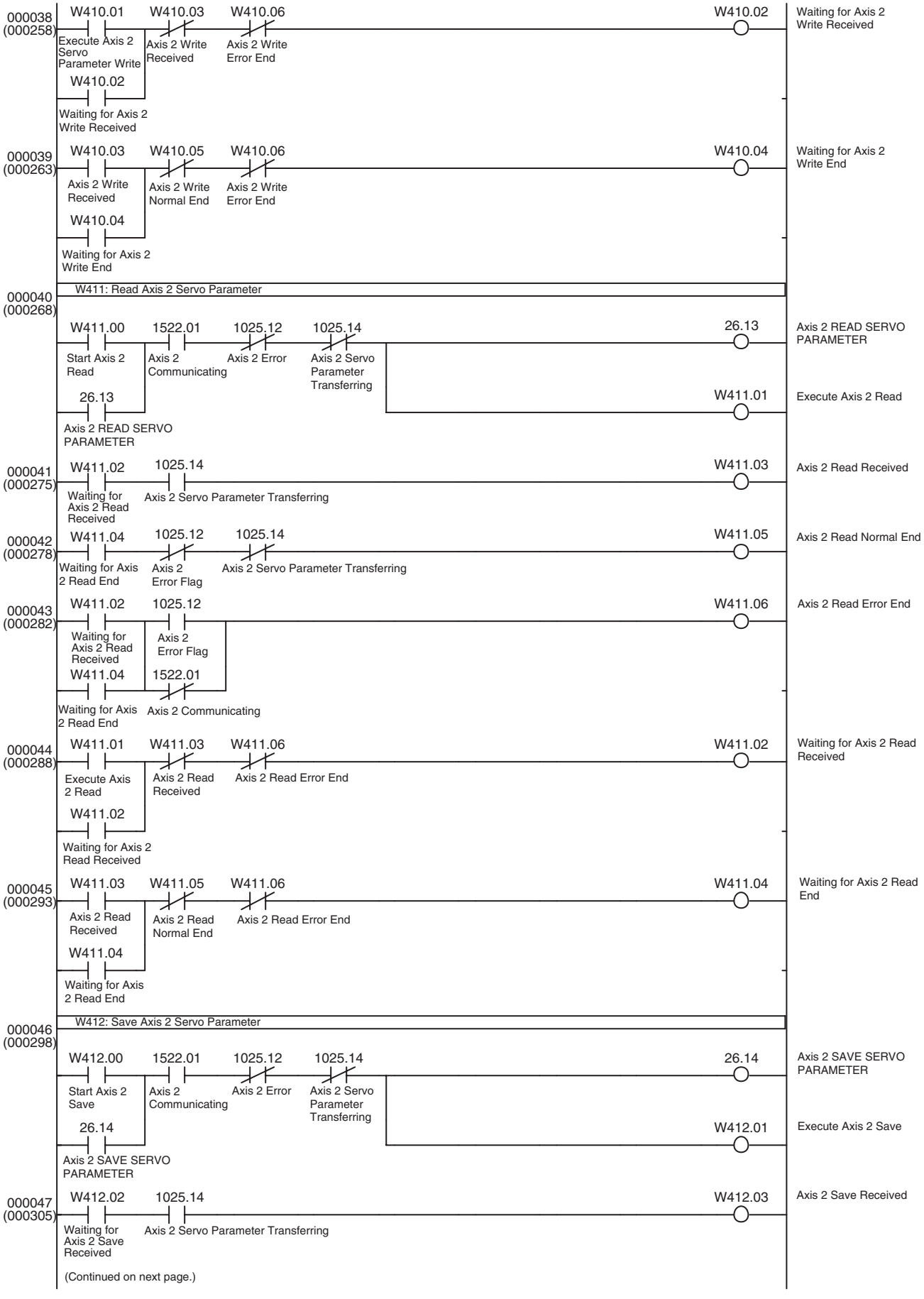
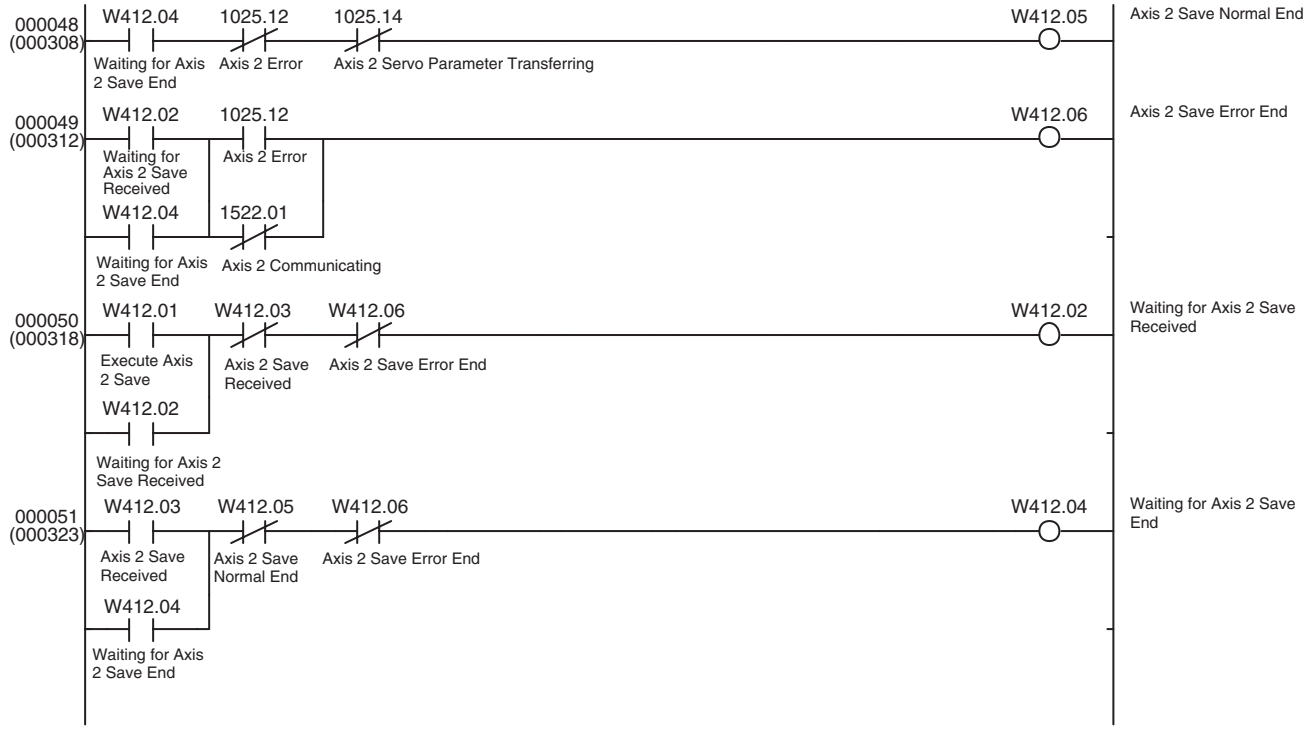

000028
(000208)
W402: Save Axis 1 Servo Parameter
W402.00
Start Axis 1 Save
1522.00
Axis 1 Communicating
1000.12
Axis 1 Error
1000.14
Axis 1 Servo Parameter Transferring
1.14
Axis 1 SAVE SERVO PARAMETER
1.14
Axis 1 SAVE SERVO PARAMETER
W402.01
Execute Axis 1 Save
000029
(000215)
W402.02
Waiting for Axis 1 Save Received
1000.14
Axis 1 Servo Parameter Transferring
W402.03
Axis 1 Save Received
000030
(000218)
W402.04
Waiting for Axis 1 Save End
1000.12
Axis 1 Error
1000.14
Axis 1 Servo Parameter Transferring
W402.05
Axis 1 Save Normal End
000031
(000222)
W402.02
Waiting for Axis 1 Save Received
1000.12
Axis 1 Error
W402.04
Waiting for Axis 1 Save End
1522.00
Axis 1 Communicating
W402.06
Axis 1 Save Error End
000032
(000228)
W402.01
Execute Axis 1 Save
W402.03
Axis 1 Save Received
W402.06
Axis 1 Save Error End
W402.02
Waiting for Axis 1 Save Received
W402.02
Waiting for Axis 1 Save Received
000033
(000233)
W402.03
Axis 1 Save Received
W402.05
Axis 1 Save Normal End
W402.06
Axis 1 Save Error End
W402.04
Waiting for Axis 1 Save End
W402.04
Waiting for Axis 1 Save End
000034
(000238)
W410: Save Axis 2 Servo Parameter
W410.00
Start Axis 2 Save
1522.01
Axis 2 Communicating
1025.12
Axis 2 Error
1025.14
Axis 2 Servo Parameter Transferring
26.12
Axis 2 SAVE SERVO PARAMETER
26.12
Axis 2 SAVE SERVO PARAMETER
W410.01
Execute Axis 2 Write
000035
(000245)
W410.02
Waiting for Axis 2 Save Received
1025.14
Axis 2 Servo Parameter Transferring
W410.03
Axis 2 Write Received
000036
(000248)
W410.04
Waiting for Axis 2 Save End
1025.12
Axis 2 Error
1025.14
Axis 2 Servo Parameter Transferring
W410.05
Axis 2 Write Normal End
000037
(000252)
W410.02
Waiting for Axis 2 Save Received
1025.12
Axis 2 Error
W410.04
Waiting for Axis 2 Save End
1522.01
Axis 2 Communicating
W410.06
Axis 2 Write Error End
(Continued on next page.)


000038 (000258)
W410.01
W410.03
W410.06
W410.02
Waiting for Axis 2 Write Received
Execute Axis 2 Servo Parameter Write
Axis 2 Write Received
Axis 2 Write Error End
W410.02
Waiting for Axis 2 Write Received
000039 (000263)
W410.03
W410.05
W410.06
W410.04
Waiting for Axis 2 Write End
Axis 2 Write Received
Axis 2 Write Normal End
Axis 2 Write Error End
W410.04
Waiting for Axis 2 Write End
000040 (000268)
W411: Read Axis 2 Servo Parameter
W411.00
1522.01
1025.12
1025.14
26.13
Axis 2 READ SERVO PARAMETER
Start Axis 2 Read
Axis 2 Communicating
Axis 2 Error
Axis 2 Servo Parameter Transferring
W411.01
Execute Axis 2 Read
26.13
Axis 2 READ SERVO PARAMETER
000041 (000275)
W411.02
1025.14
W411.03
Axis 2 Read Received
Waiting for Axis 2 Read Received
Axis 2 Servo Parameter Transferring
000042 (000278)
W411.04
1025.12
1025.14
W411.05
Axis 2 Read Normal End
Waiting for Axis 2 Read End
Axis 2 Error Flag
Axis 2 Servo Parameter Transferring
000043 (000282)
W411.02
1025.12
W411.06
Axis 2 Read Error End
Waiting for Axis 2 Read Received
Axis 2 Error Flag
W411.04
1522.01
Waiting for Axis 2 Read End
Axis 2 Communicating
000044 (000288)
W411.01
W411.03
W411.06
W411.02
Waiting for Axis 2 Read Received
Execute Axis 2 Read
Axis 2 Read Received
Axis 2 Read Error End
W411.02
Waiting for Axis 2 Read Received
000045 (000293)
W411.03
W411.05
W411.06
W411.04
Waiting for Axis 2 Read End
Axis 2 Read Received
Axis 2 Read Normal End
Axis 2 Read Error End
W411.04
Waiting for Axis 2 Read End
000046 (000298)
W412: Save Axis 2 Servo Parameter
W412.00
1522.01
1025.12
1025.14
26.14
Axis 2 SAVE SERVO PARAMETER
Start Axis 2 Save
Axis 2 Communicating
Axis 2 Error
Axis 2 Servo Parameter Transferring
W412.01
Execute Axis 2 Save
26.14
Axis 2 SAVE SERVO PARAMETER
000047 (000305)
W412.02
1025.14
W412.03
Axis 2 Save Received
Waiting for Axis 2 Save Received
Axis 2 Servo Parameter Transferring
(Continued on next page.)



11-3-3 Switching among Position, Speed, and Torque Control

Overview

The basic program examples introduced in the following sections are combined to perform position, speed, and torque control.

11-2-3 Transferring Servo Parameters (Used to transfer acceleration/deceleration constants for positioning.)
11-2-4 Servo Lock/Unlock
11-2-6 Positioning (Absolute Movement or Relative Movement)
11-2-7 Speed Control
11-2-8 Torque Control
11-2-9 Deceleration Stop or Emergency Stop

This program uses I/O bits to execute the Servo Lock/Unlock function, start controlling an axis (positioning, speed control, or torque control), or switch the control status of an operating axis.

In this example, only axis 1 is controlled.

This application example is normally executed after the initial PCU settings application shown in *11-3-1 Initial PCU Settings*.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory.

CPU Bus Unit Area

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

Data Memory Area (DM Area)

Axis operation command settings:	D1000 to D1011
Units conversion calculation:	D1500 to D1515
Expanded Monitoring:	D1020 to D1023
Axis 1 Servo Parameter transfer:	D10500 to D10503

These words are used to store the axis operation command values, calculate the command's units, store expanded monitoring values, and store the Servo Parameter transfer information (parameter number, parameter size, and two-word transfer data).

Work Area (WR Area)

Servo Lock/Unlock:	W305.00 to W305.06
Positioning:	W201.00 to W201.03
Speed Control:	W202.00 to W202.02
Torque Control:	W203.00 to W203.02
Deceleration Stop:	W204.00 and W204.01
Emergency Stop:	W205.00 and W205.01
Expanded Monitoring Switch:	W210.00 to W210.02
Axis 1 Write Servo Parameters:	W400.00 to W400.06
Change Acceleration/Deceleration Constant:	W501.00 to W501.06

These Work Area bits are used to show the progress of function execution and the execution status.

Holding Area (HR Area)

H1.00

This bit is used as a switch to indicate whether the positioning command is ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

Timer Area

TIM0003

Used as a watchdog timer to monitor the positioning operation.

I/O Bits

CIO 500.00 to CIO 500.05 and CIO 500.14 to CIO 500.15

The following table shows the axis 1 operations that can be started by this program as well as the I/O bit operations and command values (in the DM Area), which start that axis 1 operation.

Word/bit	Function	Explanation
CIO 050000	Axis 1 Servo Lock/ Unlock Switch	Each time this bit is turned ON, it switches axis 1 between Servo Lock and Servo Unlock. When the Servo Unlock is executed during speed control or torque control, the Servo Unlock is executed after executing an Emergency Stop.
CIO 050001	Start Axis 1 Positioning	When this bit goes from OFF to ON, positioning starts according to the position command value in D1000 and D1001 or the speed command value in D1002 and D1003. The positioning method can be switched between absolute/relative movement by turning H1.00 ON/OFF. H1.00 ON: ABSOLUTE MOVEMENT H1.00 OFF: RELATIVE MOVEMENT Also, the acceleration constant (deceleration constant) can be set to the value in D1010 (D1011) before starting the positioning operation if CIO 0500.14 (CIO 0500.15) is turned ON before turning this bit from OFF to ON. When positioning is started with CIO 0500.14 and/or CIO 0500.15 OFF, positioning will be performed with the acceleration constant and/or deceleration constant set in the Servo Drive.
CIO 050002	Start Axis 1 Speed Control	When this bit goes from OFF to ON, speed control starts according to the speed command value in D1002 and D1003.
CIO 050003	Start Axis 1 Torque Control	When this bit goes from OFF to ON, torque control starts according to the torque command value in D1004 and D1005, with the speed command value in D1002 and D1003 as the speed limit value.
CIO 050004	Start Axis 1 Deceleration Stop	A Deceleration Stop is executed when this bit goes from OFF to ON.
CIO 050005	Start Axis 1 Emergency Stop	An Emergency Stop is executed when this bit goes from OFF to ON.
CIO 050014	Specify Axis 1 Acceleration Constant	If CIO 0500.01 (Axis 1 Start Positioning) is turned from OFF to ON while this bit is ON, positioning will be executed with the acceleration constant specified in D1010. (Before positioning is started, the new constant is written to the acceleration constant Servo Parameter.)
CIO 050015	Specify Axis 1 Deceleration Constant	If CIO 0500.01 (Axis 1 Start Positioning) is turned from OFF to ON while this bit is ON, positioning will be executed with the deceleration constant specified in D1011. (Before positioning is started, the new constant is written to the deceleration constant Servo Parameter.)
D1000 D1001	Axis 1 Position Command Value	These words contain the position command value used in positioning. Set in the “command units.”
D1002 D1003	Axis 1 Speed Command Value	These words contain the speed command value used in positioning and speed control. This value is also used as the speed limit value during torque control. Set in “command units/s.” Speed command value for speed control and speed limit value for torque control are calculated in this program from this set value and the Servomotor's momentary maximum rotation speed, encoder resolution, and electronic gear ratio.
D1004 D1005	Axis 1 Torque Command Value	This is the torque command value used in torque control. Set the torque command value as a percentage of the Servomotor's momentary maximum torque, in units of 0.001%.

Word/bit	Function	Explanation
D1010	Axis 1 Acceleration Constant	This word contains the acceleration constant for positioning. If CIO 0500.14 is ON when positioning is started, the contents of this word are written to the Servo Parameter to change the acceleration rate. Set in units of "×10,000 command units/s^2."
D1011	Axis 1 Deceleration Constant	This word contains the deceleration constant for positioning. If CIO 0500.15 is ON when positioning is started, the contents of this word are written to the Servo Parameter to change the deceleration rate. Set in units of "×10,000 command units/s^2."

The setting value in D1002 and D1003 is used as the speed command value in position and speed control. In torque control, it is used as the speed limit value.

The PCU's speed command value for speed control and the speed limit value for torque control (option command value 1) are set as a percentage of the Servomotor's momentary maximum rotation speed (units: 0.001%), so they are calculated as follows in this program.

Use the following equation as a template and change the equation in this program when the Servomotor's momentary maximum rotation speed, encoder resolution, or electronic gear ratio are different.

Speed command value for speed control and speed limit value for torque control = Speed command value (command units/s) × 60 (s) / (Servomotor momentary maximum rotation speed (r/min) × Encoder resolution (pulses/rotation) × 4/Electronic gear ratio)/0.001%

An R88M-W10030L W-series Servomotor is used in this sample program. In this case,

Momentary maximum rotation speed:5,000 r/min
Encoder resolution: 2,048 pulses/rotation

The electronic gear ratio is contained in Servo Parameters (Pn202/Pn203) and the default setting is 4 (Pn202 = 4 and Pn203 = 1).

Consequently, the units calculation is as follows:

Speed command value for speed control and speed limit value for torque control
= Speed command value (command units/s) × 60/ (5,000 × 2,048 × 4/4) × 100,000
= Speed command value (command units/s) × 6,000,000 / 10,240,000

In this program, the fraction is reduced to 1,200/2,048 to prevent the multiplication or division from overflowing.

Note When torque control is being performed, option command value 1 is used as the speed limit value, so set parameter Pn002.1 (Speed command input change) to 1 to select option command value 1.

If the Servo Unlock function is executed during speed control or torque control, this program will output the Servo Unlock command after executing an Emergency Stop (see the output circuit for W305.06).

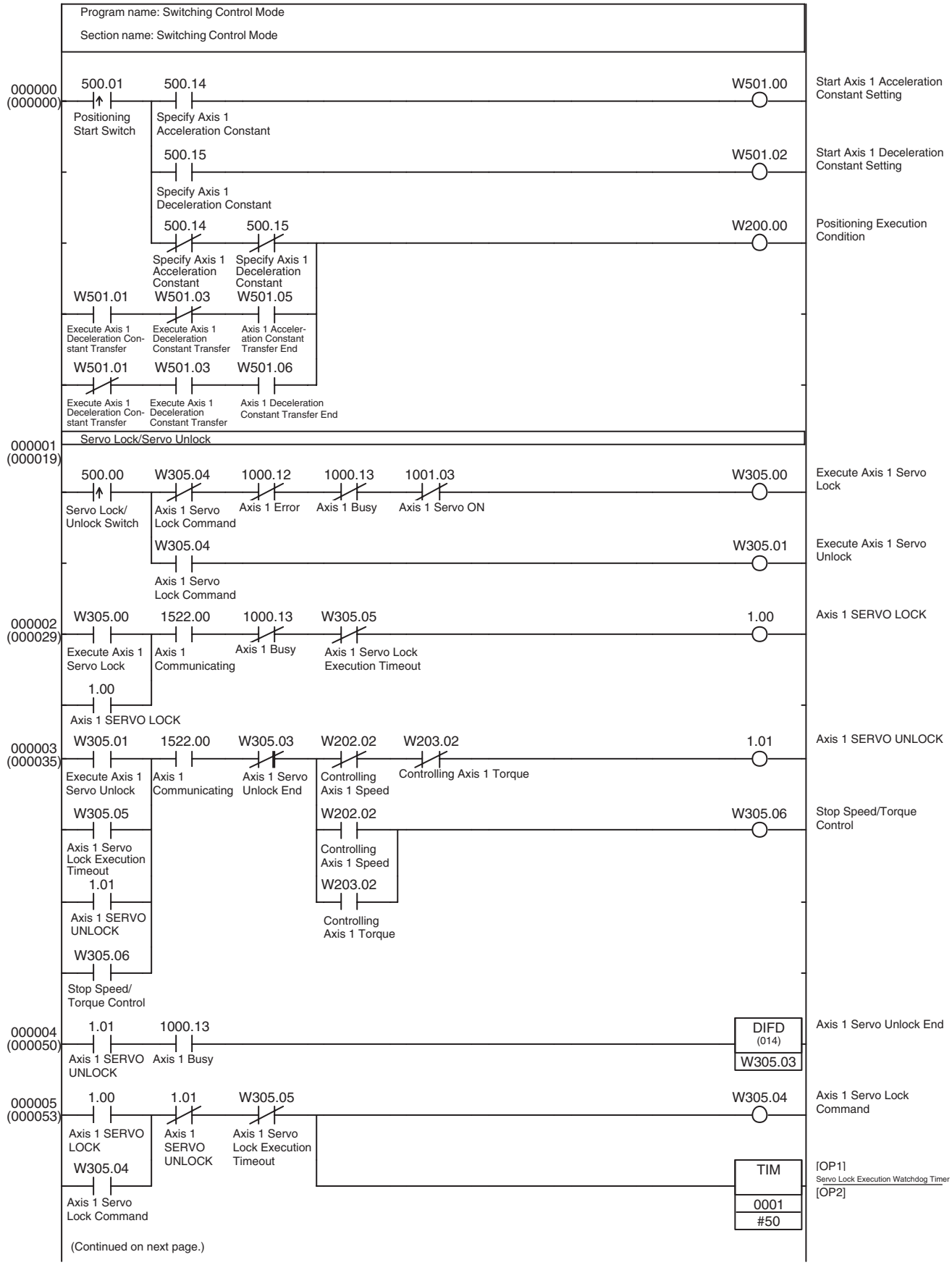
In addition, the feedback speed and torque command are monitored in this program with the PCU's Expanded Monitoring function.

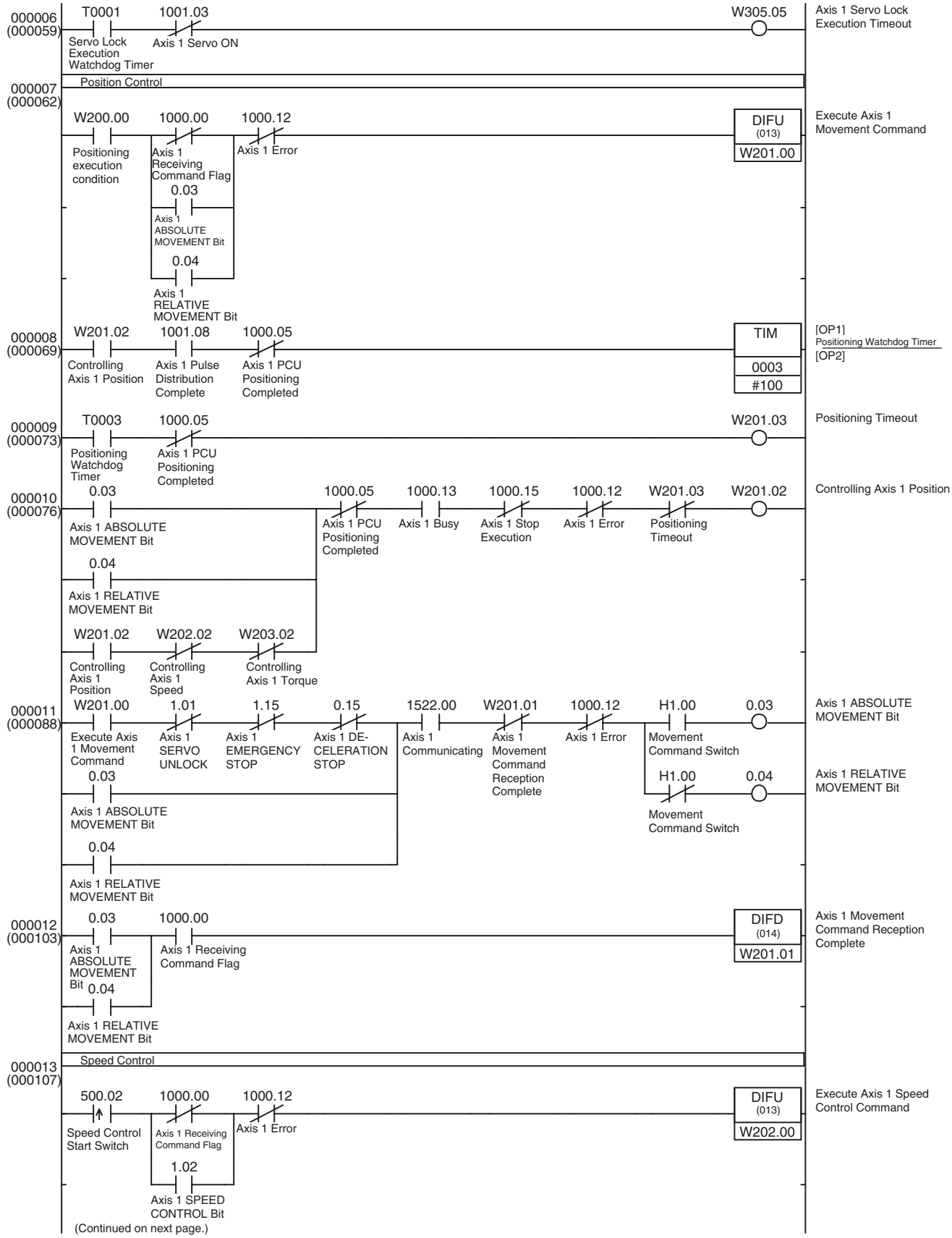
Since the speed and torque units used for monitoring depend on the control mode (position control, speed control, or torque control), the monitoring units are converted in this program and output to D1020 to D1021 and D1022 to D1023. Refer to *4-8-6 Expanded Monitoring* for details on the monitoring units used in each control mode.

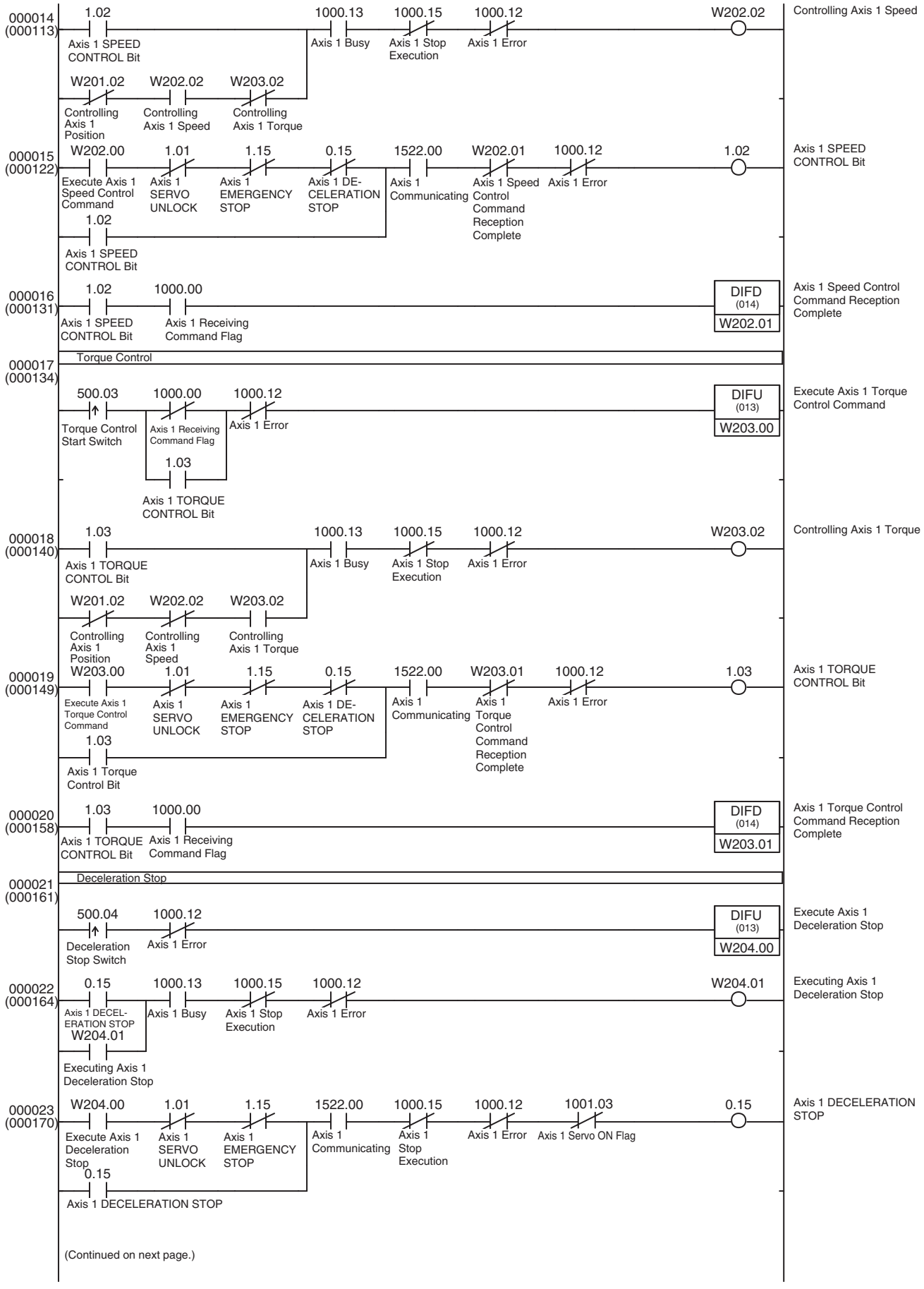
In this program, the unit conversion methods are switched at the start of axis operation. The speed monitoring units are converted (0.001% → command units/s) during speed control and the torque monitoring units are converted (0.001% →%) during torque control.

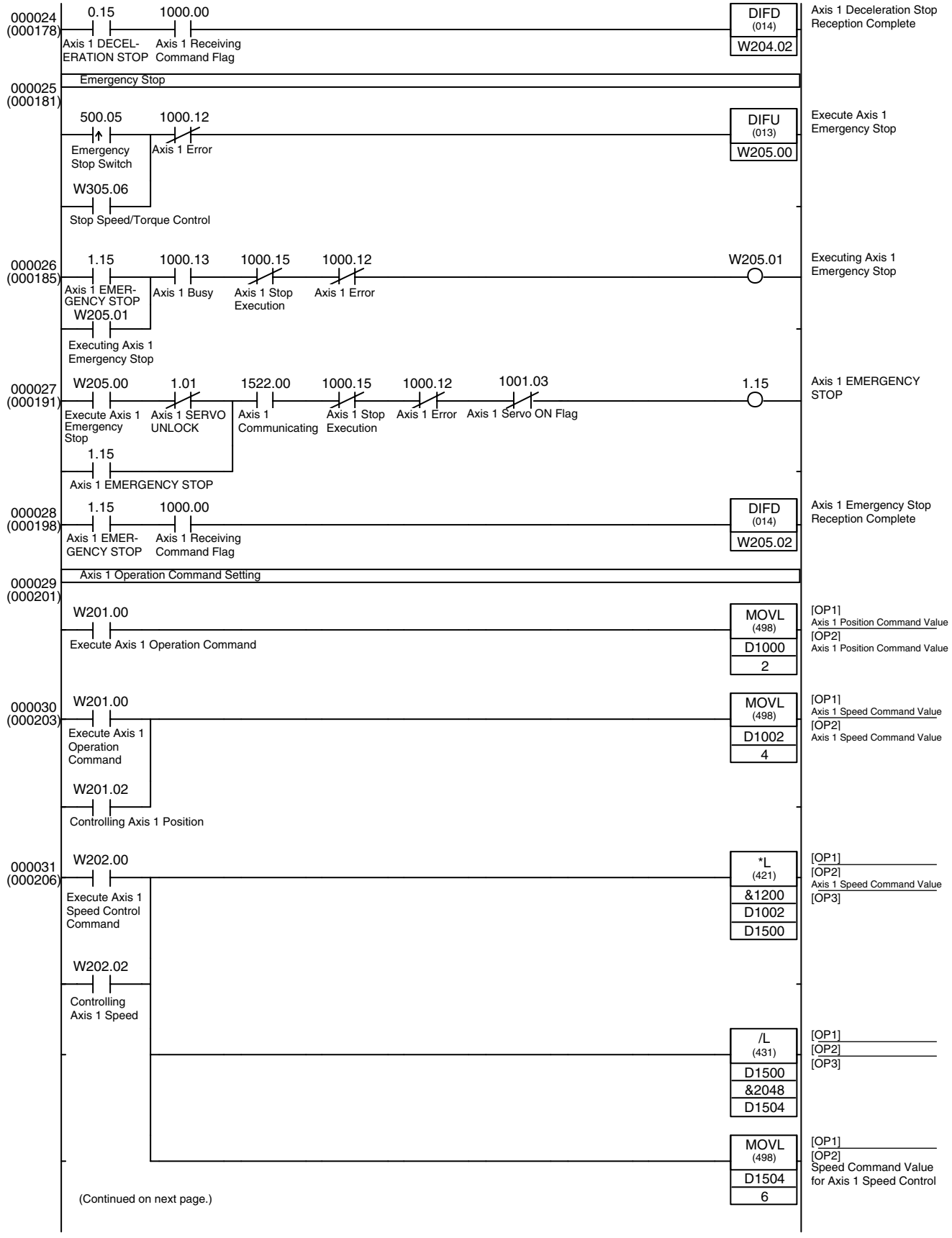
(The conversion of speed monitoring units is performed by reversing the equation used to convert the speed command value for speed control.)

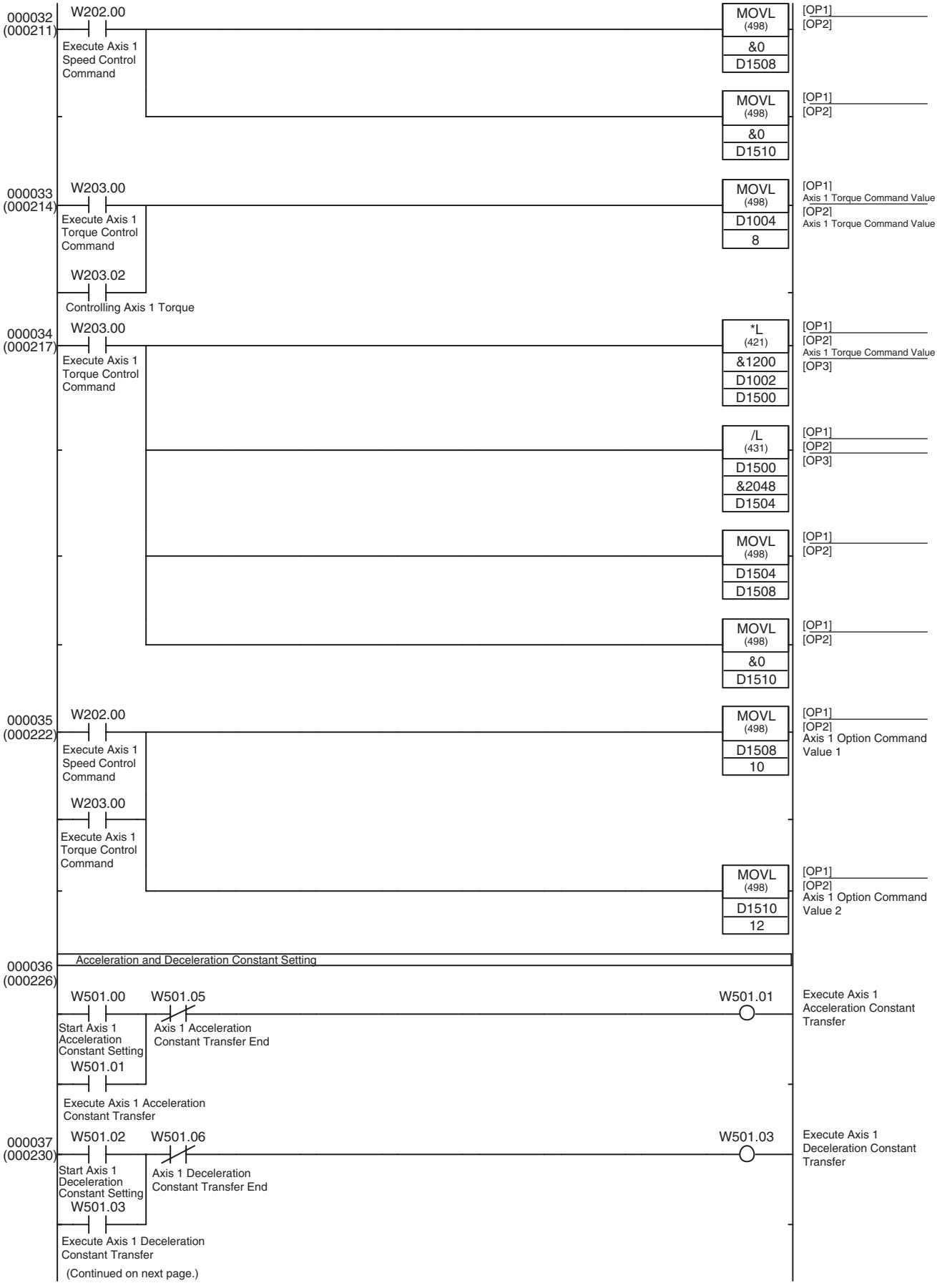
Sample Ladder Program

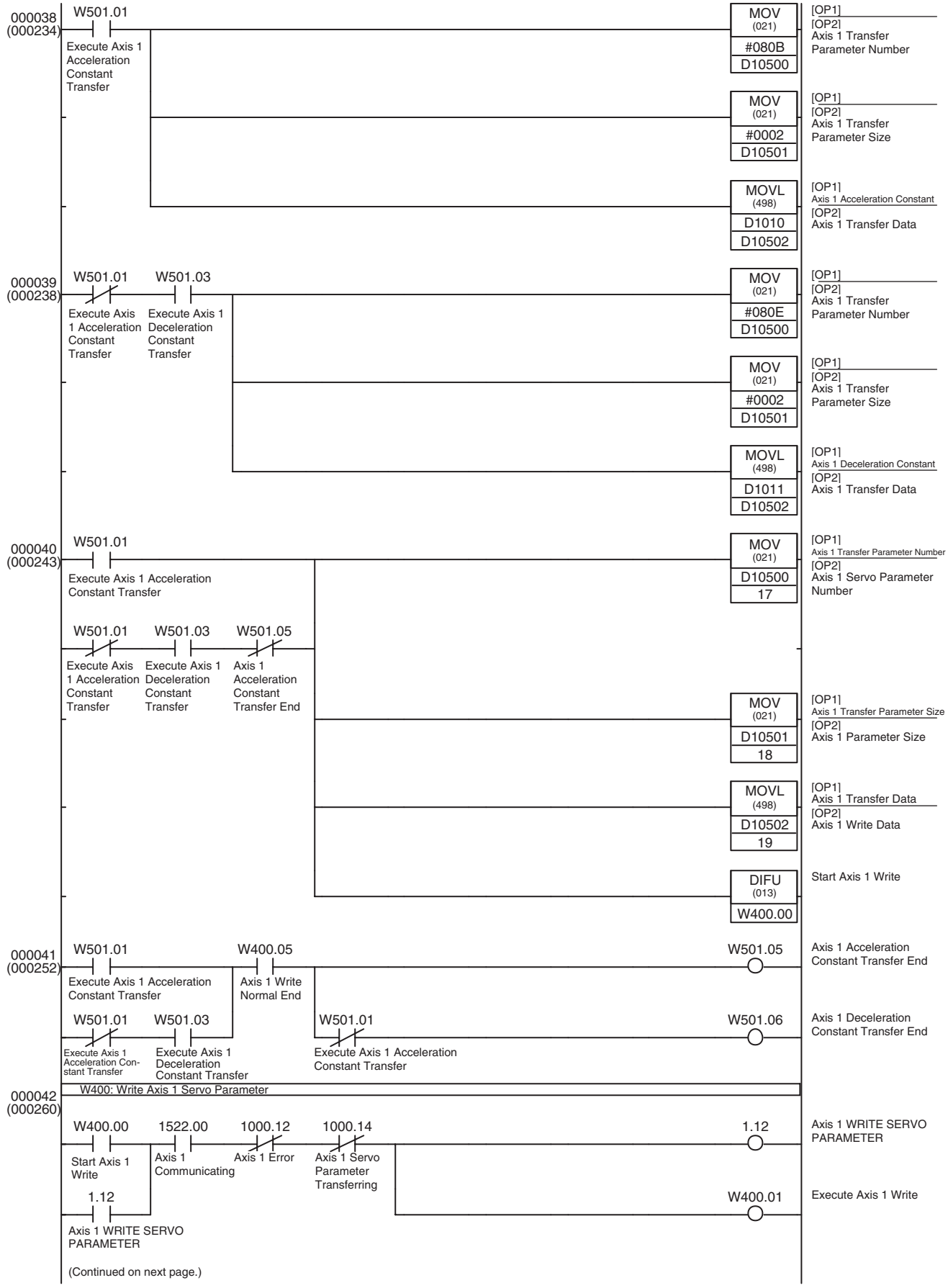



000006
(000059)
T0001
Servo Lock Execution Watchdog Timer
1001.03
Axis 1 Servo ON
W305.05
Axis 1 Servo Lock Execution Timeout
000007
(000062)
Position Control
W200.00
Positioning execution condition
1000.00
Axis 1 Receiving Command Flag
1000.12
Axis 1 Error
0.03
Axis 1 ABSOLUTE MOVEMENT Bit
0.04
Axis 1 RELATIVE MOVEMENT Bit
DIFU
(013)
W201.00
Execute Axis 1 Movement Command
000008
(000069)
W201.02
Controlling Axis 1 Position
1001.08
Axis 1 Pulse Distribution Complete
1000.05
Axis 1 PCU Positioning Completed
TIM
0003
#100
[OP1]
Positioning Watchdog Timer
[OP2]
000009
(000073)
T0003
Positioning Watchdog Timer
1000.05
Axis 1 PCU Positioning Completed
W201.03
Positioning Timeout
000010
(000076)
0.03
Axis 1 ABSOLUTE MOVEMENT Bit
0.04
Axis 1 RELATIVE MOVEMENT Bit
1000.05
Axis 1 PCU Positioning Completed
1000.13
Axis 1 Busy
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
W201.03
Positioning Timeout
W201.02
Controlling Axis 1 Position
W201.02
Controlling Axis 1 Position
W202.02
Controlling Axis 1 Speed
W203.02
Controlling Axis 1 Torque
000011
(000088)
W201.00
Execute Axis 1 Movement Command
1.01
Axis 1 SERVO UNLOCK
1.15
Axis 1 EMERGENCY STOP
0.15
Axis 1 DE-CELERATION STOP
1522.00
Axis 1 Communicating
W201.01
Axis 1 Movement Command Reception Complete
1000.12
Axis 1 Error
H1.00
Movement Command Switch
0.03
Axis 1 ABSOLUTE MOVEMENT Bit
0.03
Axis 1 ABSOLUTE MOVEMENT Bit
H1.00
Movement Command Switch
0.04
Axis 1 RELATIVE MOVEMENT Bit
0.04
Axis 1 RELATIVE MOVEMENT Bit
000012
(000103)
0.03
Axis 1 ABSOLUTE MOVEMENT Bit
0.04
Axis 1 RELATIVE MOVEMENT Bit
1000.00
Axis 1 Receiving Command Flag
DIFD
(014)
W201.01
Axis 1 Movement Command Reception Complete
000013
(000107)
Speed Control
500.02
Speed Control Start Switch
1000.00
Axis 1 Receiving Command Flag
1000.12
Axis 1 Error
1.02
Axis 1 SPEED CONTROL Bit
DIFU
(013)
W202.00
Execute Axis 1 Speed Control Command
(Continued on next page.)


000014 (000113)
1.02
Axis 1 SPEED CONTROL Bit
1000.13
Axis 1 Busy
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
W202.02
Controlling Axis 1 Speed
W201.02
Controlling Axis 1 Position
W202.02
Controlling Axis 1 Speed
W203.02
Controlling Axis 1 Torque
000015 (000122)
W202.00
Execute Axis 1 Speed Control Command
1.01
Axis 1 SERVO UNLOCK
1.15
Axis 1 EMERGENCY STOP
0.15
Axis 1 DE-CELERATION STOP
1522.00
Axis 1 Communicating
W202.01
Axis 1 Speed Control Command Reception Complete
1000.12
Axis 1 Error
1.02
Axis 1 SPEED CONTROL Bit
Axis 1 SPEED CONTROL Bit
000016 (000131)
1.02
Axis 1 SPEED CONTROL Bit
1000.00
Axis 1 Receiving Command Flag
DIFD (014)
W202.01
Axis 1 Speed Control Command Reception Complete
000017 (000134)
Torque Control
500.03
Torque Control Start Switch
1000.00
Axis 1 Receiving Command Flag
1000.12
Axis 1 Error
1.03
Axis 1 TORQUE CONTROL Bit
DIFU (013)
W203.00
Execute Axis 1 Torque Control Command
000018 (000140)
1.03
Axis 1 TORQUE CONTOL Bit
1000.13
Axis 1 Busy
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
W203.02
Controlling Axis 1 Torque
W201.02
Controlling Axis 1 Position
W202.02
Controlling Axis 1 Speed
W203.02
Controlling Axis 1 Torque
000019 (000149)
W203.00
Execute Axis 1 Torque Control Command
1.01
Axis 1 SERVO UNLOCK
1.15
Axis 1 EMERGENCY STOP
0.15
Axis 1 DE-CELERATION STOP
1522.00
Axis 1 Communicating
W203.01
Axis 1 Torque Control Command Reception Complete
1000.12
Axis 1 Error
1.03
Axis 1 TORQUE CONTROL Bit
1.03
Axis 1 Torque Control Bit
000020 (000158)
1.03
Axis 1 TORQUE CONTROL Bit
1000.00
Axis 1 Receiving Command Flag
DIFD (014)
W203.01
Axis 1 Torque Control Command Reception Complete
000021 (000161)
Deceleration Stop
500.04
Deceleration Stop Switch
1000.12
Axis 1 Error
DIFU (013)
W204.00
Execute Axis 1 Deceleration Stop
000022 (000164)
0.15
Axis 1 DECEL-ERATION STOP
1000.13
Axis 1 Busy
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
W204.01
Executing Axis 1 Deceleration Stop
W204.01
Executing Axis 1 Deceleration Stop
000023 (000170)
W204.00
Execute Axis 1 Deceleration Stop
1.01
Axis 1 SERVO UNLOCK
1.15
Axis 1 EMERGENCY STOP
1522.00
Axis 1 Communicating
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
1001.03
Axis 1 Servo ON Flag
0.15
Axis 1 DECELERATION STOP
0.15
Axis 1 DECELERATION STOP
(Continued on next page.)


000024
(000178)
0.15
Axis 1 DECEL-ERATION STOP
1000.00
Axis 1 Receiving Command Flag
DIFD (014)
W204.02
Axis 1 Deceleration Stop Reception Complete
000025
(000181)
Emergency Stop
500.05
Emergency Stop Switch
1000.12
Axis 1 Error
W305.06
Stop Speed/Torque Control
DIFU (013)
W205.00
Execute Axis 1 Emergency Stop
000026
(000185)
1.15
Axis 1 EMER-GENCY STOP
1000.13
Axis 1 Busy
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
W205.01
Executing Axis 1 Emergency Stop
W205.01
Executing Axis 1 Emergency Stop
000027
(000191)
W205.00
Execute Axis 1 Emergency Stop
1.01
Axis 1 SERVO UNLOCK
1522.00
Axis 1 Communicating
1000.15
Axis 1 Stop Execution
1000.12
Axis 1 Error
1001.03
Axis 1 Servo ON Flag
1.15
Axis 1 EMERGENCY STOP
1.15
Axis 1 EMERGENCY STOP
000028
(000198)
1.15
Axis 1 EMER-GENCY STOP
1000.00
Axis 1 Receiving Command Flag
DIFD (014)
W205.02
Axis 1 Emergency Stop Reception Complete
000029
(000201)
Axis 1 Operation Command Setting
W201.00
Execute Axis 1 Operation Command
MOVL (498)
D1000
2
[OP1] Axis 1 Position Command Value
[OP2] Axis 1 Position Command Value
000030
(000203)
W201.00
Execute Axis 1 Operation Command
W201.02
Controlling Axis 1 Position
MOVL (498)
D1002
4
[OP1] Axis 1 Speed Command Value
[OP2] Axis 1 Speed Command Value
000031
(000206)
W202.00
Execute Axis 1 Speed Control Command
W202.02
Controlling Axis 1 Speed
*L (421)
&1200
D1002
D1500
[OP1]
[OP2] Axis 1 Speed Command Value
[OP3]
/L (431)
D1500
&2048
D1504
[OP1]
[OP2]
[OP3]
MOVL (498)
D1504
6
[OP1]
[OP2] Speed Command Value for Axis 1 Speed Control
(Continued on next page.)


000032
(000211)
W202.00
Execute Axis 1 Speed Control Command
MOVL (498)
&0
D1508
[OP1]
[OP2]
MOVL (498)
&0
D1510
[OP1]
[OP2]
000033
(000214)
W203.00
Execute Axis 1 Torque Control Command
W203.02
Controlling Axis 1 Torque
MOVL (498)
D1004
8
[OP1]
Axis 1 Torque Command Value
[OP2]
Axis 1 Torque Command Value
000034
(000217)
W203.00
Execute Axis 1 Torque Control Command
*L (421)
&1200
D1002
D1500
[OP1]
[OP2]
Axis 1 Torque Command Value
[OP3]
/L (431)
D1500
&2048
D1504
[OP1]
[OP2]
[OP3]
MOVL (498)
D1504
D1508
[OP1]
[OP2]
MOVL (498)
&0
D1510
[OP1]
[OP2]
000035
(000222)
W202.00
Execute Axis 1 Speed Control Command
W203.00
Execute Axis 1 Torque Control Command
MOVL (498)
D1508
10
[OP1]
[OP2]
Axis 1 Option Command Value 1
MOVL (498)
D1510
12
[OP1]
[OP2]
Axis 1 Option Command Value 2
000036
(000226)
Acceleration and Deceleration Constant Setting
W501.00
Start Axis 1 Acceleration Constant Setting
W501.05
Axis 1 Acceleration Constant Transfer End
W501.01
Execute Axis 1 Acceleration Constant Transfer
W501.01
Execute Axis 1 Acceleration Constant Transfer
000037
(000230)
W501.02
Start Axis 1 Deceleration Constant Setting
W501.06
Axis 1 Deceleration Constant Transfer End
W501.03
Execute Axis 1 Deceleration Constant Transfer
W501.03
Execute Axis 1 Deceleration Constant Transfer
(Continued on next page.)



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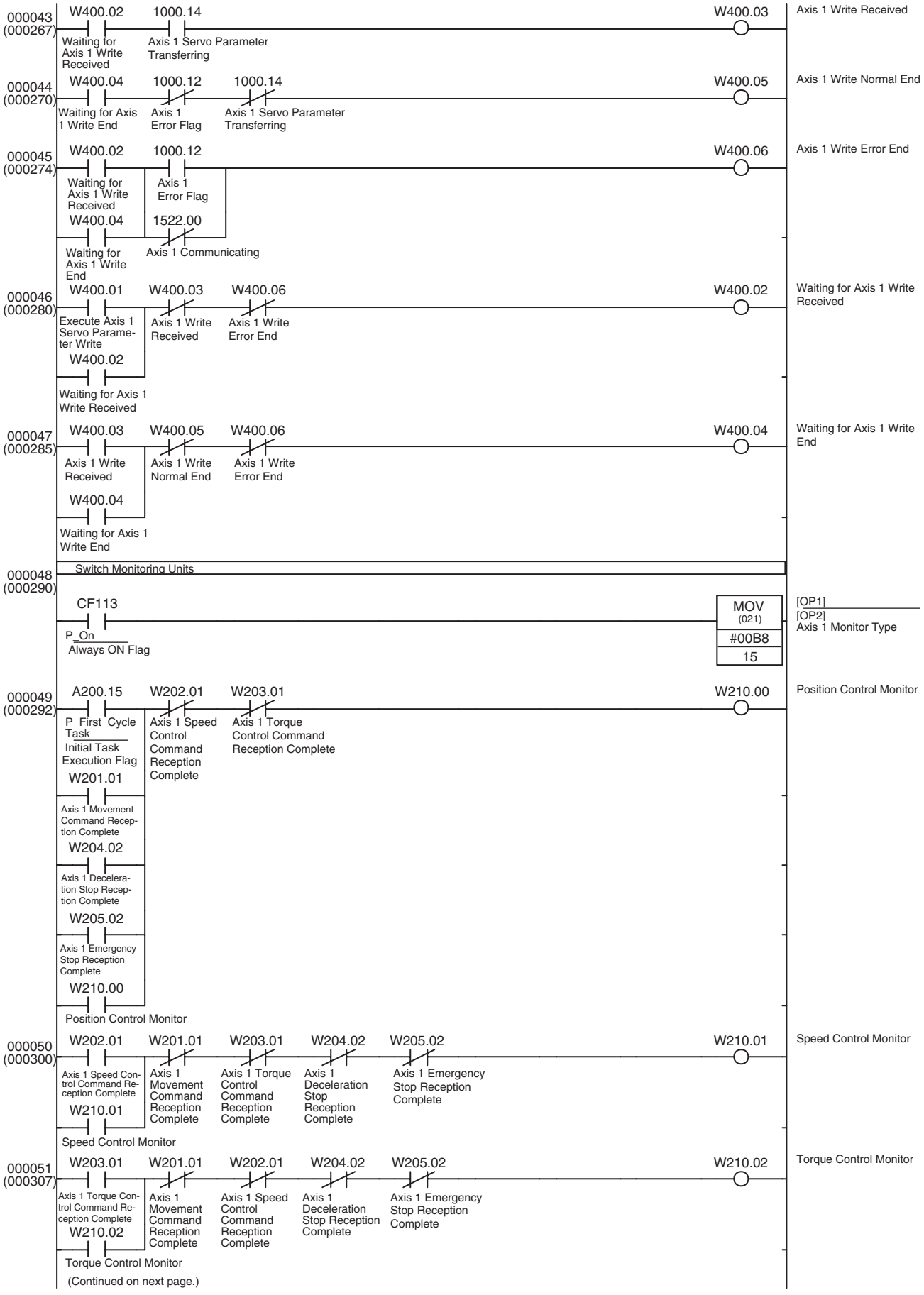

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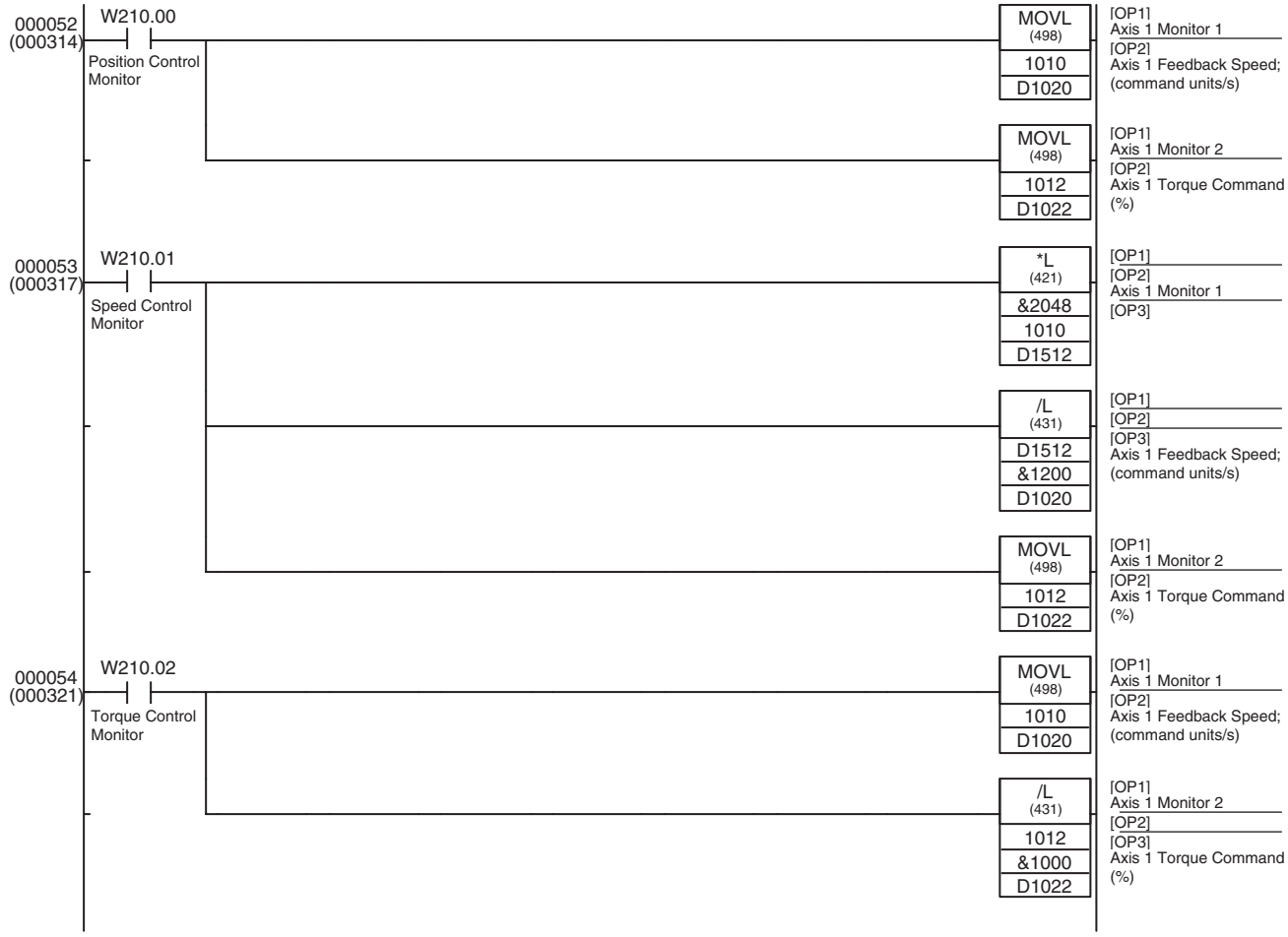
000052
(000314)
W210.00
Position Control Monitor
MOVL (498)
1010
D1020
[OP1] Axis 1 Monitor 1
[OP2] Axis 1 Feedback Speed; (command units/s)
MOVL (498)
1012
D1022
[OP1] Axis 1 Monitor 2
[OP2] Axis 1 Torque Command (%)
000053
(000317)
W210.01
Speed Control Monitor
*L (421)
&2048
1010
D1512
[OP1]
[OP2] Axis 1 Monitor 1
[OP3]
/L (431)
D1512
&1200
D1020
[OP1]
[OP2]
[OP3] Axis 1 Feedback Speed; (command units/s)
MOVL (498)
1012
D1022
[OP1] Axis 1 Monitor 2
[OP2] Axis 1 Torque Command (%)
000054
(000321)
W210.02
Torque Control Monitor
MOVL (498)
1010
D1020
[OP1] Axis 1 Monitor 1
[OP2] Axis 1 Feedback Speed; (command units/s)
/L (431)
1012
&1000
D1022
[OP1] Axis 1 Monitor 2
[OP2]
[OP3] Axis 1 Torque Command (%)

SECTION 12
Troubleshooting

This section provides information on troubleshooting errors that may occur, including details on the meaning of indicator displays and error codes, and the procedures required to reset errors in the Unit or axes.

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12-1 Overview of PCU Errors

The PCU detects errors that occur in the PCU, MECHATROLINK communications, or the MECHATROLINK slave device and sends notification of the error to the CPU Unit.

The errors that are detected by the PCU can be divided broadly into problems common to the PCU and those in each of the controlled axes. The CPU Unit is notified of any errors according to the cause of the detected error and its location, as shown in the following table.

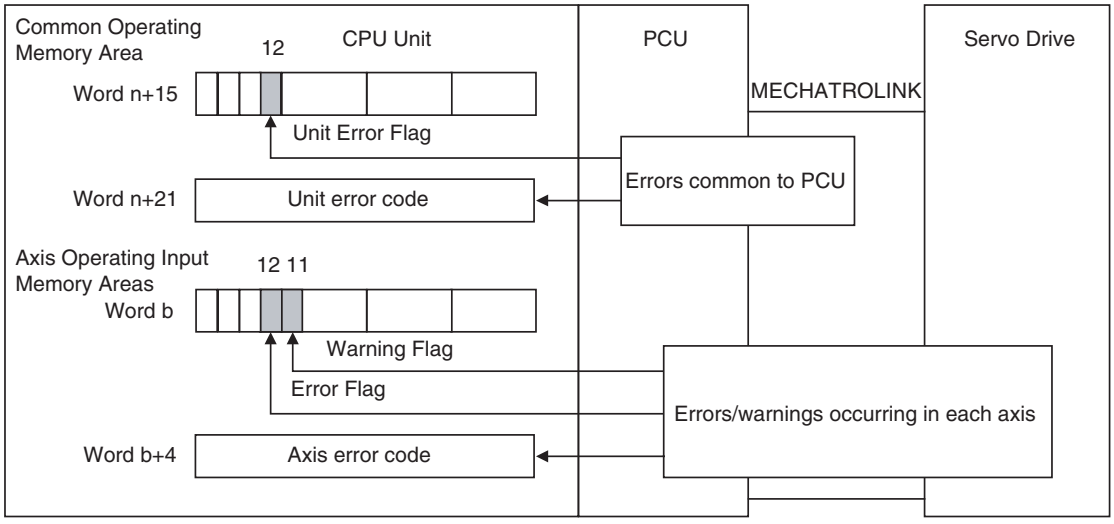
Category	Source of error	Error/ warning	Cause of error						Notification from PCU	Interface area
			Errors at powerup (initialization errors)	CPU Unit errors	PCU internal errors	MECHATROLINK communications errors	PCU settings/ operation errors	MECHATROLINK slave device errors		
Unit common	PCU	Error	Causes Unit common error	Causes Unit common error	Causes Unit common error	Causes Unit common error	Causes Unit common error	Does not cause Unit common error	Unit Error Flag, Unit error code	Common Operating Memory Area
Axis errors	PCU	Error	Does not cause axis error	Does not cause axis error	Does not cause axis error	Causes axis error	Causes axis error	Does not cause axis error	(Axis) Error Flag, Axis error code	Axis Operating Input Memory Areas
	MECHATROLINK slave device	Error	Does not cause axis error	Does not cause axis error	Does not cause axis error	Causes axis error	Causes axis error	Causes axis error		
		Warning	Does not cause axis error	Does not cause axis error	Does not cause axis error	Does not cause axis error	Does not cause axis error	Causes axis error	(Axis) Warning Flag, Axis error code	

Note

(1) MECHATROLINK communications errors are either related to all communications or occur in individual axes, and are notified either as Unit common errors or as axis errors.

(2) The PCU settings/operation errors are caused due to operations either common to the PCU or in each axis, and are notified either as Unit common errors or as axis errors.

The following diagram shows the operation error notification.



n = CIO 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

If an error occurs, the PCU operates according to the following table depending on the cause of the detected error.

The errors common to the PCU can be cleared by setting the UNIT ERROR RESET Bit in the Common Operating Memory Area, and errors that occur in axes are cleared by setting the ERROR RESET Bit in the Axis Operating Output Memory Areas.

Operation after error	Cause of error						Status after error		ERROR RESET
	Errors at powerup (initialization errors)	CPU Unit errors	PCU internal errors	MECHATROLINK communications errors	PCU Settings/operation errors	MECHATROLINK slave device errors	MECHATROLINK communications	Servomotor carrying current	
System stopped	Causes PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Connection released.	Servomotor not carrying current (See note 2.) (Servo OFF)	Not possible
Connection released suddenly	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Causes PCU operation on the left	Does not cause PCU operation on the left	Connection released.	Servomotor not carrying current (See note 2.) (Servo OFF)	Not possible
Connection released after deceleration stop	Does not cause PCU operation on the left	Causes PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Connection released.	Servomotor not carrying current (See note 2.) (Servo OFF)	Possible only for CPU Unit monitor errors.
Servo OFF	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Connection not released.	Servomotor not carrying current (Servo OFF)	Possible
Emergency stop	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Connection not released.	Maintains previous status	Possible
Deceleration stop	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Causes PCU operation on the left	Causes PCU operation on the left	Connection not released.	Maintains previous status	Possible (See note 4.)
Maintains	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Does not cause PCU operation on the left	Causes PCU operation on the left	Causes PCU operation on the left	See note 1.	Maintains previous status	Maintains previous status	Possible

Note

(1) If a warning occurs in a MECHATROLINK slave device, the Warning Flag will turn ON and operation will continue.

(2) When a connection is released by the PCU, the Servo Drive will be put in the Servo OFF state.

(3) The operations and status for MECHATROLINK slave device errors above indicate the PCU operation (i.e., the command sent to the slave device when an error occurs). The operation of the MECHATROLINK slave device in which the error occurred depends on the device's specifications.

(4) MECHATROLINK communications errors that occur in individual axes cannot be cleared by setting the AXIS ERROR RESET Bit in the Axis Operating Output Memory Areas. (For details, refer to *Errors in MECHATROLINK Communications* in this section.)

If two or more errors occur at the same time, the errors are processed in the order of priority starting from the most important error, as shown in the following table, and the error codes are refreshed.

If two or more errors of the same priority level occur at the same time, the error status of the error that was detected first will be maintained (the error code for the error that was detected first will be held).

Category	PCU operation if error occurs	Priority level	Details
Unit common errors	System stopped Connection released suddenly Connection released after deceleration stop	High ↑	
Individual axis error	MECHATROLINK communications error (See note.) Servo OFF Emergency stop Deceleration stop Operation continues	↓ Low	If a Unit common error occurs while an individual axis error has occurred, the status of the Error Flag and axis error code for the axis error will be held.

Note MECHATROLINK communications errors that occur in individual axes are processed in order of highest priority among the errors that occur in each axis. (For details, refer to *Errors in MECHATROLINK Communications* in this section.)

The PCU functions are limited when an error occurs, as follows:

Error	Functions that can be performed	Functions that cannot be performed
Unit common errors (Unit Error Flag ON in the Common Operating Memory Area)	• UNIT ERROR RESET • WRITE DATA • READ DATA • SAVE DATA • Releasing connection (CONNECT Bit OFF)	• Establishing connection (CONNECT Bit ON)
Axis error (Error Flag ON in the Axis Operating Input Memory Area)	• ERROR RESET • SERVO UNLOCK • WRITE SERVO PARAMETER (See note.) • READ SERVO PARAMETER (See note.) • SAVE SERVO PARAMETER (See note.) • Switching between Monitor type 1 and 2. For details on MECHATROLINK communications errors, refer to *Errors in MECHATROLINK Communications* in this section.	• ABSOLUTE/RELATIVE MOVEMENT (with INTERRUPT FEEDING) • ORIGIN SEARCH • ORIGIN RETURN • PRESENT POSITION PRESET • JOG • DEVIATION COUNTER RESET • Changing override • DECELERATION STOP • SERVO LOCK • SPEED CONTROL • TORQUE CONTROL • DEVICE SETUP • WRITE SERVO PARAMETER (See note.) • READ SERVO PARAMETER (See note.) • SAVE SERVO PARAMETER • EMERGENCY STOP (See note.)

Note For PCUs with unit version 1.2 or earlier, parameters cannot be read, written, or saved when there is an axis error. Attempts to execute these commands

will be ignored. For PCUs with unit version 1.3 or later, parameters can be read, written, or saved even when there is an axis error.

Functions that cannot be performed during errors can be performed after executing ERROR RESET to clear the error.

Errors in MECHATROLINK Communications

The following errors are MECHATROLINK communications errors that occur in individual axes.

- Synchronous Communications Alarm (axis error code: 3010 hex)
- Communications Alarm (axis error code: 3011 hex)
- Command timeout (axis error code: 3012 hex)

These errors cannot be cleared using the AXIS ERROR RESET Bit in the Axis Operating Output Memory Areas.

These errors are related to the interface between the PCU and Servo Drive and are, therefore, given the highest priority in error processing of individual axis errors.

If these errors occur, the PCU will execute DECELERATION STOP for the corresponding axis (Servo Drive operation will depend on the stop method that is specified to be used when alarms occur in the Servo Drive) and operation of the axis will be prohibited.

To clear this error, stop MECHATROLINK communications (release connection) and then execute CONNECT again.

PCU Operation when CPU Unit Load Is Turned OFF

When the CPU Unit turns OFF the load, the PCU decelerates the active axis to a stop and releases the MECHATROLINK communications connection.

After recovering from the load OFF status, reestablish the MECHATROLINK communications connection by turning the CONNECT Bit OFF and then ON again.

Warnings

The MECHATROLINK slave device warnings that occur indicate that an error will occur if operation is continued without correcting the problem.

The type of warning and detection conditions depend on the connected MECHATROLINK slave device (Servo Drive).

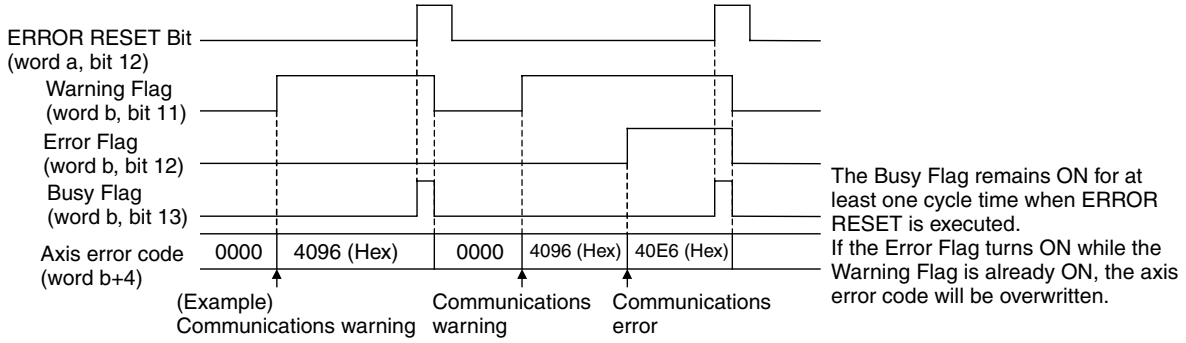
When the PCU detects a warning for the MECHATROLINK slave station device, the PCU notifies the CPU Unit, by turning ON the Warning Flag for the corresponding axis, and stores the warning code in the axis error code.

When a warning is detected, the Unit continues operation unchanged.

When a warning is detected and then the associated error occurs for the same axis, the Error Flag turns ON and the PCU performs error processing.

The axis error code will be overwritten by the error code for the error that has occurred.

Timing Chart for Axis Errors and Warnings

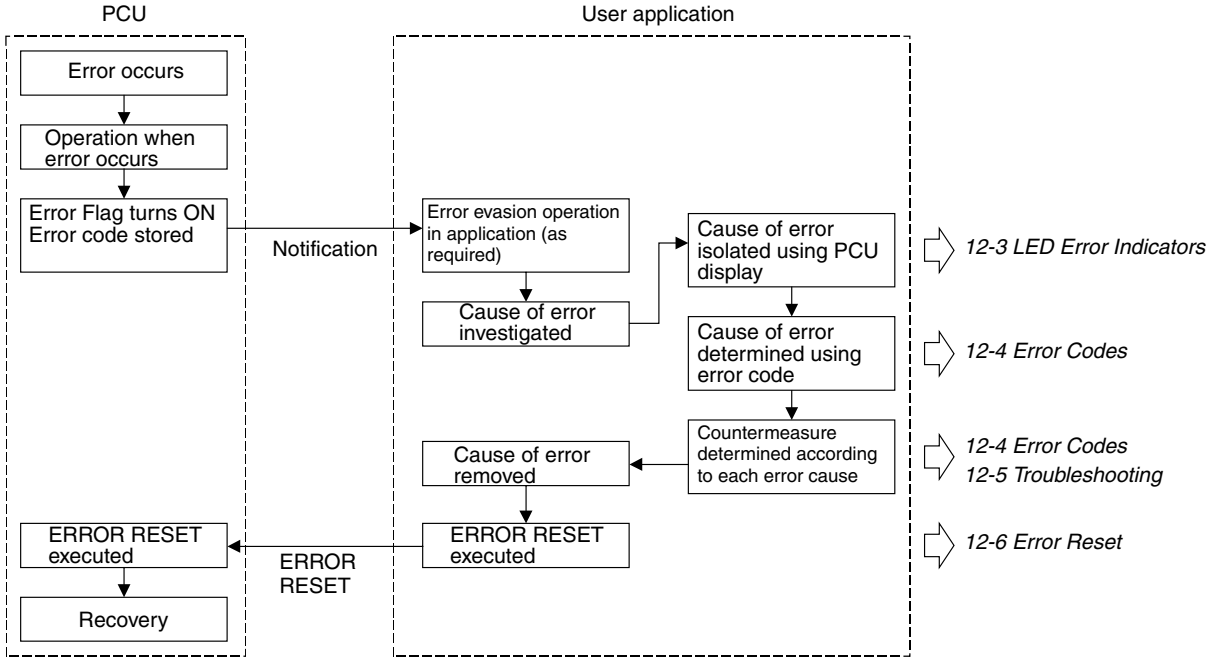


a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Note If an axis warning occurs (Warning Flag = 1), the PCUs' command response time will be delayed due to the warning processing. The PCU processing time required from receiving a command from the CPU Unit until the command is sent using MECHATROLINK communications is one MECHATROLINK communications cycle if an axis warning has not occurred, and three MECHATROLINK communications cycles if an axis warning has occurred. If the machine's operation is affected by the PCU's command response time, clear the axis warning status using ERROR RESET or disable the warnings using the Servo Drive settings.
For details on the PCU's command response time, refer to *Command Response Time* in *Appendix A Performance Characteristics*.

12-2 Troubleshooting Procedure

The basic flow of troubleshooting errors that occur in the PCU is as follows:



12-3 LED Error Indicators

The status of the LED indicators on the front of the PCU can be used to diagnose the following errors.

RUN: The PCU is operating.
ERC: An error has occurred in the PCU.
ERH: An error has occurred in the CPU Unit.
ERM: An error has occurred in the MECHATROLINK device.
MLK: Indicates MECHATROLINK communications status

The indicator displays indicate the first error that is detected.

If the cause of an error has been cleared using ALARM RESET when two or more errors have occurred at the same time, the PCU will detect the next error with the highest priority and the indicator display will switch to show the new error. If multiple errors occur with the same priority level, the error for the smaller axis number will be displayed first.

12-3-1 Error Indicators at Powerup

Indicator status					Category	Probable cause of error	Countermeasure
RUN	ERC	ERH	ERM	MLK			
Not lit	Not lit	Not lit	Not lit	Not lit	CPU Unit power interruption	Power is not being supplied correctly to the CPU Unit.	Check the power supply voltage being supplied to the CPU Unit and make sure the correct power is being supplied.
					Unit system error	The PCU system is not operating correctly.	Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU.
Not lit	Not lit	Lit	Not lit	Not lit	Setting error	The PCU's unit number is the same as another Unit.	After changing the unit number, cycle the power and create the I/O tables from the CPU Unit.
						The PCU is not registered in the CPU Unit's I/O tables, or the registered status does not match.	Create the I/O tables for the CPU Unit again.
					Data transfer error	The transfer of data between the PCU and CPU Unit could not be executed correctly.	Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU or CPU Unit.

Indicator status					Category	Probable cause of error	Countermeasure
RUN	**ERC**	**ERH**	**ERM**	**MLK**			
Not lit	Lit	Not lit	Not lit	Not lit	Unit malfunction	The internal circuits of the PCU have malfunctioned.	Replace the PCU.
Not lit	Lit	Lit	Not lit	Not lit	Unit recognition error	The CPU Unit has not recognized the PCU correctly.	Replace the PCU.

12-3-2 Error Display for CPU Unit Errors

Indicator status					Category	Probable cause of error	Countermeasure
RUN	**ERC**	**ERH**	**ERM**	**MLK**			
Lit	Flashing	Lit	Not lit	Not lit	CPU Unit error	The CPU Unit system is not operating correctly.	Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit.
						A PLC bus operation error has occurred.	
						A fatal error has occurred in the CPU Unit.	Remove the cause of the CPU Unit stopping.

The indicator displays shown in the above table indicate errors that have occurred in the CPU Unit. Check the Unit's installation status and causes for the errors in the CPU Unit.

12-3-3 Error Display for PCU Errors

Indicator status					Category	Probable cause of error	Countermeasure
RUN	**ERC**	**ERH**	**ERM**	**MLK**			
Lit	Lit	Not lit	Not lit	Not lit	Data corrupted	The data saved in the PCU is corrupted.	Transfer and save the PCU data again, and then restart the Unit or turn the power OFF and ON again.
					Unit error	An error has occurred in the internal circuits of the PCU.	Replace the PCU.

The indicator displays shown in the above table indicate that data in the PCU is corrupted or the PCU's internal circuits have malfunction.

Data may be corrupted if the PCU power is interrupted while data is being saved to the PCU's internal flash memory. Use PCU's SAVE DATA or the CPU Unit's simple backup function to restore (read) data saved in the Memory Card or perform another process to recover saved data.

If the error occurs again, the probable cause is a faulty PCU. Replace the PCU.

12-3-4 Error Display for MECHATROLINK Communications Errors

Indicator status					Category	Probable cause of error	Countermeasure
RUN	ERC	ERH	ERM	MLK			
Lit	Flashing	Not lit	Lit	Undetermined	Communications error	MECHATROLINK communications cannot be performed correctly.	Check the connection of the MECHATROLINK communications cable.
					Scan list mismatch	The MECHATROLINK slave station device corresponding to the axis number registered in the PCU scan list is not connected.	Check whether the settings for the MECHATROLINK communications line connection or slave device's station address match the settings in the scan list.

This display occurs when MECHATROLINK communications are started (connection established), or during communications when MECHATROLINK communications are not connected correctly.

Check for disconnected, broken, or faulty contact in the MECHATROLINK communications cables, and check the status (power interruption, etc.) of the connected MECHATROLINK slave station devices.

Also check whether the actual connection status matches the connections registered in the scan list.

Communications errors, scan list mismatches, or other error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.

12-3-5 Error Display for PCU Settings and Operations

Indicator status					Category	Probable cause of error	Countermeasure
RUN	ERC	ERH	ERM	MLK			
Lit	Flashing	Not lit	Not lit	Undetermined	Illegal operation	An operation command that cannot be executed has been sent to the PCU.	Check the timing of the last command and change the operation sequence.
					Illegal data	Illegal parameters have been set for the PCU, or an operation command has been sent with illegal parameters.	Check the contents of the last command, and correct the contents of the data.

The indicator display shown in the above table indicates that illegal data is set in the PCU parameters or an illegal operation has been attempted, such as multistart.

This error will occur if a problem has occurred in the use of the PCU, which requires the PCU settings or user program to be corrected.

The error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.

12-3-6 Error Display for MECHATROLINK Slave Station Device Errors

Indicator status					Category	Probable cause of error	Countermeasure
RUN	ERC	ERH	ERM	MLK			
Lit	Flashing	Not lit	Flashing	Lit	External sensor input	An error has occurred due to external sensor input detection.	Check the machine status and remove the cause of the error.
					Servo Drive error	The main circuit power of the Servo Drive has been turned OFF.	Check the power supply voltage being supplied to the Servo Drive's main circuit power supply and make sure the correct power is being supplied.

The indicator display shown in the above table indicates that the limit input has been detected, Servo Drive's main circuit power supply is OFF, or an error specific to the Servo Drive or another error in the machine or Servo Drive has occurred.

Check whether the cause of the error is a machine error, a faulty sensor, disconnection, or Servo Drive error.

The error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.

12-4 Error Codes

12-4-1 Overview

When an error occurs in the PCU, an Error Flag is turned ON and an error code is input in the Common Operating Memory Area or the Axis Operating Input Memory Areas.

The area in which the Error Flag is turned ON and the input error code indicate the type of error and in which axis the error occurred.

Common Operating Memory Area

Name	Word	Bit	Contents
Unit Error Flag	n+15	12	0: Unit common error has not occurred. 1: Unit common error has occurred.
Unit error code	n+21	---	Stores the error code when a Unit common error occurs.

n = CIO 1500 + (unit number × 25)

Error information in this area indicates errors that occur in the PCU or that are not specific to a particular axis.

The Unit common error code is indicated as 00□□ hex.

If the Unit Error Flag turns ON, error processing must be performed for the PCU or the whole system including the PCU.

Axis Operating Input Memory Areas

Name	Word	Bit	Contents
Error Flag	b	12	0: No error 1: Error has occurred
Axis error code	b+4	---	Stores the error code for the error that occurred in an individual axis.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Error information in this area indicates errors that have occurred in individual axes.

The Axis error code is indicated as 3□□□ hex or 4□□□ hex.

If an Axis Error Flag turns ON, error processing must be performed for the corresponding axis.

Determine the cause of the error using the indicator display and error code, isolating the location of the error as either in the PCU or in the Servo Drive/ Machine.

12-4-2 List of Error Codes

PCU Common Errors

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
Errors at powerup	Not lit	Not lit	Not lit	Not lit	Not lit	CPU Unit power interruption	Power interruption	---	Power is not being supplied correctly to the CPU Unit.	Check the power supply voltage being supplied to the CPU Unit and make sure the correct power is being supplied.	---
						Unit system error	Watchdog timer operation	---	The PCU system is not operating correctly.	Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU.	System stopped
	Not lit	Not lit	Lit	Not lit	Not lit	Setting error	Unit number error	---	The PCU's unit number is the same as another Unit.	After changing the unit number, cycle the power and create the I/O tables from the CPU Unit.	System stopped
							Unit recognition incomplete	---	The PCU is not registered in the CPU Unit's I/O tables, or the registered status does not match.	Create the I/O tables for the CPU Unit again.	System stopped
						Data transfer error	Data transfer error	---	The transfer of data between the PCU and CPU Unit at initialization of the PCU could not be executed correctly.	Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU or CPU Unit.	System stopped
	Not lit	Lit	Not lit	Not lit	Not lit	Unit malfunction	Common memory error	---	The internal circuits of the PCU have malfunctioned.	Replace the PCU.	System stopped
	Not lit	Lit	Lit	Not lit	Not lit	Unit recognition error	Unit recognition error	---	The CPU Unit has not recognized the PCU correctly.	Replace the PCU.	System stopped

The above errors for which the RUN indicator is not lit occur when starting PCU operations, such as turning ON the power or restarting the Unit. The PCU system does not start correctly if any of these errors occurs, so the Error Flags and error codes cannot be checked from the CPU Unit.

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	**ERC**	**ERH**	**ERM**	**MLK**						
CPU Unit errors	Lit	Flashing	Lit	Not lit	Not lit	CPU Unit error	CPU fatal error	000A	An error causing the CPU Unit to stop has occurred.	Remove the cause of the CPU Unit stopping.	Connection released after deceleration stop
							CPU Unit watchdog timer error	000B	The CPU Unit system is not operating correctly.	Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit.	Connection released after deceleration stop
							CPU Unit monitor error	000C	The cyclic refresh from the CPU Unit to the PCU has stopped.	Check the error status of the CPU Unit and perform appropriate error processing. After restarting the cyclic refresh with the CPU Unit, execute PCU's ERROR RESET.	Connection released after deceleration stop
							Bus error	000D	PLC bus operation error	Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit.	Connection released after deceleration stop
PCU internal errors	Lit	Lit	Not lit	Not lit	Not lit	Unit error	MLK device error	0026	An error has occurred in the internal circuits of the PCU.	Replace the PCU.	System stopped
							MLK device initialization error	0030	An error has been detected in the MECHATROLINK communications part during PCU initialization processing.	Check the MECHATROLINK communications settings in the Common Parameters, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU.	System stopped
						Data corrupted	Memory error	00F1	The data saved in the PCU is corrupted.	Transfer and save the PCU data again, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU.	System stopped

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	**ERC**	**ERH**	**ERM**	**MLK**						
MECHATROLINK communications errors	Lit	Flashing	Not lit	Lit	Undetermined	Scan list mismatch	MLK initialization error	0020	The MECHATROLINK slave station device corresponding to the axis number registered in the PCU scan list is not connected.	Check whether the settings for the MECHATROLINK communications line connection or slave device's station address match the settings in the scan list, and then execute CONNECT again.	Maintains (Axes that have a connection established cannot be operated for PCUs with unit version 1.2 or earlier.)
						Communications error	MLK communications error	0025	MECHATROLINK communications cannot be performed correctly, or two or more MECHATROLINK slave station devices are using the same station number.	Check the connection of the MECHATROLINK communications cable. After removing the noise or other the cause preventing communications, restart the PCU.	Connection released suddenly

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	**ERC**	**ERH**	**ERM**	**MLK**						
PCU settings and operations errors	Lit	Flashing	Not lit	Not lit	Undetermined	Illegal operation	Multistart error	0021	An operation command that cannot be executed has been sent to the PCU.	The operation command that was sent cannot be executed. Check the last command timing and change the operation sequence.	Maintains
							FINS command time monitoring error	0024	Communications between the computer and PCU were interrupted for more than 5 s after switching the CX-Motion-NCF to an operation monitor window.	Check the communications path between the computer and PLC and remove any problems. The Position Control Unit is set to continue monitoring communications with the computer. Restart the PCU to clear the communications monitoring status.	Connection released after deceleration stop
						Illegal data	Write transfer error	0022	An attempt has been made for the PCU to write data to an illegal address, or to write data using an illegal data size.	The data transfer for the command cannot be executed. Check the contents of the last command, and correct the data transfer settings.	Maintains
							Read transfer error	0023	An attempt has been made for the PCU to read data from an illegal address, or to read data with an illegal data size.	The data transfer for the command cannot be executed. Check the contents of the last command, and correct the data transfer settings.	Maintains
							Transfer cycle setting error	0027	The set value for the transfer cycle set in the PCU's Common Parameters is too small for the number and type of connected MECHATROLINK devices or the maximum axis number.	Set and save a transfer cycle set value in the Common Parameters that is suitable for the number and type of connected MECHATROLINK devices and the maximum axis number, and then restart the PCU.	Connection released suddenly
							Initialization common parameter check error	0028	An illegal set value has been detected in the Common Parameters during PCU initialization. (See note.)	When this error occurs, the corresponding setting in the Common Parameters is set to the default value (0). After executing ERROR RESET, transfer and save the correct Common Parameter setting and restart the PCU.	Maintains
							Data transfer common parameter check error	0029	An illegal set value in the Common Parameters was transferred to the PCU using WRITE DATA. (See note.)	The transferred set value is discarded and the set value in the Common Parameters before the transfer is restored. After executing ERROR RESET, transfer the correct Common Parameters setting.	Maintains

Note An error will occur if the scan list contains more than the maximum number of axes for the CS1W-NC271/NC471 or CJ1W-NC271/NC471.

Individual Axis Errors

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
MECHATROLINK communications errors	Lit	Flashing	Not lit	Lit	Undetermined	Communications error	Synchronous communications alarm	3010	MECHATROLINK communications cannot be performed correctly with the corresponding axis.	Check the connection of the MECHATROLINK communications cable. After removing the cause preventing communications, such as breaks or noise in the connection, execute CONNECT again.	Operation stops according to the method used when the Servo Drive alarm occurs. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited.
							Communications alarm	3011	MECHATROLINK communications cannot be performed correctly with the corresponding axis.	Check the connection of the MECHATROLINK communications cable. After removing the cause preventing communications, such as breaks or noise in the connection, execute CONNECT again.	Operation stops according to the method set in the Servo Drive for alarms. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited.
							Command timeout	3012	No MECHATROLINK communications response has been received from the corresponding axis. When connected to an R88D-WN□-ML2 Servo Drive, this error will occur if a Servo Parameter is transferred with an illegal parameter size.	After checking that no error has occurred in the MECHATROLINK device connected to the corresponding axis, execute CONNECT again. If this error occurs when transferring a Servo Parameter to the R88D-WN□-ML2 Servo Drive, check whether the Servo Parameter is being transferred with an illegal parameter size.	Operation stops according to the method used when the Servo Drive alarm occurs. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited.

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
PCU settings and operation errors	Lit	Flashing	Not lit	Not lit	Lit	Illegal operation	Present position unknown error	3030	ABSOLUTE MOVEMENT or ORIGIN RETURN was executed before the origin was established.	Execute ORIGIN SEARCH or PRESENT POSITION PRESET and after defining the origin, execute the previously unsuccessful command again.	Deceleration stop
							Servo unlock error	3040	A command to start the axis was executed while in Servo unlock status.	Execute the SERVO LOCK and then execute the previously unsuccessful command again.	The command to start the axis is ignored and the Servo Drive remains in Servo unlock status.
							Multistart error	3050	An attempt was made to execute two or more of the following commands at the same time for the same axis. ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG, SPEED CONTROL, TORQUE CONTROL, or DEVICE SETUP	After editing the ladder program so that multiple command bits do not turn ON at the same time for the same axis, execute the previously unsuccessful command again.	Deceleration stop
									An attempt was made to execute one of the following commands for a busy axis. ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG, or DEVICE SETUP	After editing the ladder program so that command bits do not turn ON for a busy axis, execute the previously unsuccessful command again.	

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
PCU settings and operation errors	Lit	Flashing	Not lit	Not lit	Lit	Illegal data	Position designation error	3060	An attempt was made to execute RELATIVE MOVEMENT using a position command value for the target position that is outside the positioning range.	Edit the position command value to be within the positioning range and execute the command again.	Deceleration stop
							Speed designation error	3061	An attempt was made to execute one of the following commands with a negative value as the speed command value. ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, and JOG	Edit the speed command value to be within the setting range and execute the command again.	Deceleration stop
									An attempt was made to execute ORIGIN SEARCH with a speed command value of 0.	Edit the speed command value to be within the setting range and execute the command again.	
							Speed control speed designation error	3062	An attempt was made to execute SPEED CONTROL using a command value that exceeds the speed command range.	Edit the speed command value to be within the setting range and execute the command again.	Deceleration stop
							Torque command value error	3063	An attempt was made to execute TORQUE CONTROL using a command value that exceeds the torque command range.	Edit the torque command value to be within the setting range and execute the command again.	Deceleration stop

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
PCU settings and operation errors	Lit	Flashing	Not lit	Not lit	Lit	Illegal data	Option command value 1 error	3064	An attempt was made to execute SPEED/ TORQUE CONTROL using a command value that exceeds the command range in option command value 1.	Edit the option command value to be within the setting range and execute the command again.	Deceleration stop
							Option command value 2 error	3065	An attempt was made to execute SPEED CONTROL using a command value that exceeds the command range in option command value 2.	Edit the option command value to be within the setting range and execute the command again.	Deceleration stop
							Override	3070	An attempt was made to execute the override using an override value outside the setting range.	Edit the override value to be within the setting range and execute the command again.	Deceleration stop
							Initialization axis parameter check error	3090	An illegal set value has been detected in the Axis Parameters during PCU initialization.	When this error occurs, the corresponding setting in the Axis Parameters is set to the default value (0). After executing ERROR RESET, transfer the correct Axis Parameter.	Deceleration stop
							Data transfer axis parameter check error	3091	An illegal set value in the Axis Parameters was transferred to the PCU using WRITE DATA.	The transferred set value is discarded and the set value in the Axis Parameters before the transfer is restored. After executing ERROR RESET, transfer the correct Axis Parameter.	Deceleration stop
							Data setting error	3099	An attempt was made to transfer data for an illegal parameter number and outside the setting range using SERVO PARAMETER TRANSFER.	The transferred set value is discarded and the set value for the Servo Parameter before the transfer is restored. After executing ERROR RESET, transfer the correct Servo Parameter.	Deceleration stop
									A function not supported by SMARTSTEP Junior Servo Drives (e.g., torque control commands) was executed.	Check the commands for the relevant axis and correct the ladder program so that only supported functions are used.	

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
MECHATROLINK Slave Station Device Errors	Lit	Flashing	Not lit	Flashing	Lit	External sensor input	Forward rotation limit input	3000	A forward rotation limit input signal was detected.	After executing ERROR RESET, perform movement in the reverse rotation direction.	Operation stops according to the Servo Drive's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.)
							Reverse rotation limit input	3001	A reverse rotation limit input signal was detected.	After executing ERROR RESET, perform movement in the forward rotation direction.	Operation stops according to the Servo Drive's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.)
							Forward software limit	3002	The forward software limit was reached or exceeded during axis movement.	After checking the position command value and executing ERROR RESET, execute a movement command to move the axis to a correct position within the software limit range.	Operation stops according to the Servo Drive's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.)
							Reverse software limit	3003	The reverse software limit was reached or exceeded during axis movement.	After checking the position command value and executing ERROR RESET, execute a movement command to move the axis to a correct position within the software limit range.	Operation stops according to the Servo Drive's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.)
							Emergency stop signal input	3004	The emergency stop input signal (an external control input signal) was detected when the Servo was locked or an attempt was made to lock the Servo while the emergency stop input signal was ON.	Turn OFF the emergency stop input signal, reset the axis error, and repeat the operation from locking the Servo. (This error will not occur if the EMERGENCY STOP command in the Axis Operating Memory Area is used.)	Servo OFF

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	**ERC**	**ERH**	**ERM**	**MLK**						
MECHATROLINK Slave Station Device Errors	Lit	Flashing	Not lit	Flashing	Lit	Origin search error	No origin proximity or origin input signal	3020	The origin proximity input signal could not be detected within the range of both limit input signals during an origin search.	Check the origin proximity input signal wiring and the signal's allocation setting in the Servo Parameters. Check that the dog width of the origin proximity input signal is no shorter than the communications cycle.	Operation stops according to the Servo Drive's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.)
									After detecting the origin proximity input signal during an origin search operation, a limit input signal was detected before detecting the origin input signal.	Check that the origin input signal selection in the PCU's Axis Parameters is correct. When the external latch signal is selected as the origin input signal, check the external latch signal wiring and the allocation setting in the Servo Parameters.	
							Limit input already ON	3021	The limit input signal in the origin search direction has already been input during a single-direction origin search.	Check the limit input signal wiring for the corresponding direction and check the limit input signal's allocation setting in the Servo Parameters.	Emergency stop (the operation command is not executed)
							Limit input signal ON in both directions	3022	Origin search cannot be executed due to limit input signals being input in both directions.	Check the limit input signal wiring in both directions and check the limit input signal allocation settings in the Servo Parameters.	Emergency stop (the operation command is not executed)
						Servo Drive error	Drive main circuit OFF error (See note.)	3080	The main circuit power of the Servo Drive has been turned OFF.	Check the power supply voltage being supplied to the Servo Drive's main circuit power supply and make sure the correct power is being supplied.	Servo OFF
						MECHATROLINK device alarm	---	4000 + Alarm code for each device	The error processing depends on the device.		Operation stops according to the specified method when the Servo Drive alarm occurs. (The PCU executes DECELERATION STOP.)

Note For PCUs with unit version 1.2 or earlier, driver main circuit OFF errors can be detected regardless of whether the axis is servo-locked. For PCUs with unit version 1.3 or later, driver main circuit OFF errors will be detected only when the axis is servo-locked and will not be detected when the axis is not servo-locked.

Individual Axis Warnings

	Indicator status					Category	Error name	Error code	Probable cause	Clearing method	Operation after error
	RUN	ERC	ERH	ERM	MLK						
MECHATROLINK slave station device	Lit	Not lit	Not lit	Not lit	Lit	MECHATROLINK device warning	---	4000 + Warning code for each device	The error processing depends on the device.		Operation continues

MECHATROLINK Device Alarms (Alarm Code 4□□□ Hex)

When an alarm or warning occurs for one of the connected MECHATROLINK slave station devices, the PCU turns ON the Error Flag or Warning Flag and returns the following error code.

G-series Servo Drives

Error code: 4□□□ hex

The numbers in the boxes of the error codes displayed for alarms are given as decimal numbers for the Servo Drives and as hexadecimal numbers for the Position Control Units.

The same numbers are given in the boxes of the error codes displayed for warnings for the Servo Drives and the Position Control Units.

Example: Position deviation overflow alarm (deviation counter overflow)

Servo Drive alarm display: A.24

The PCU's error code in this example is 4018.

Example: Battery warning

Servo Drive warning display: A.92

The PCU's error code in this example is 4092.

For details on alarm display and warning display numbers, and the difference between Servo Drives and Position Control Units, refer to the list in *Appendix D List of Error Codes*.

W-series and SMARTSTEP Junior Servo Drives

Error code: 40□□ hex

The boxes (□□) indicate the alarm/display number for the Servo Drive.

When using an R88D-WN□-ML2 W-series Servo Drive (with built-in MECHATROLINK-II communications), however, only the upper two digits of the display number's three digits will be displayed.

Example: Position deviation overflow alarm (deviation counter overflow)

R88D-WT□ W-series Servo Drive:

Servo Drive alarm display: A.D0

The PCU's error code in this example is 40D0 hex.

R88D-WN□-ML2 W-series Servo Drive:
Position deviation overflow alarm: A.D00
Servo ON position deviation overflow alarm: A.D01
Servo ON speed limit position deviation overflow alarm: A.D02

With the R88D-WN□-ML2 W-series Servo Drives, more detailed information is provided for position deviation overflow alarms, as shown above, but only the upper two digits of the alarm code (40D0 hex) are displayed as the PCU's error code for any of these alarms.

For details on alarm displays and warning displays in Servo Drives, refer to the list in *Appendix D List of Error Codes*.

For details on alarm/warning contents, refer to the operation manual for the Servo Drive being used.

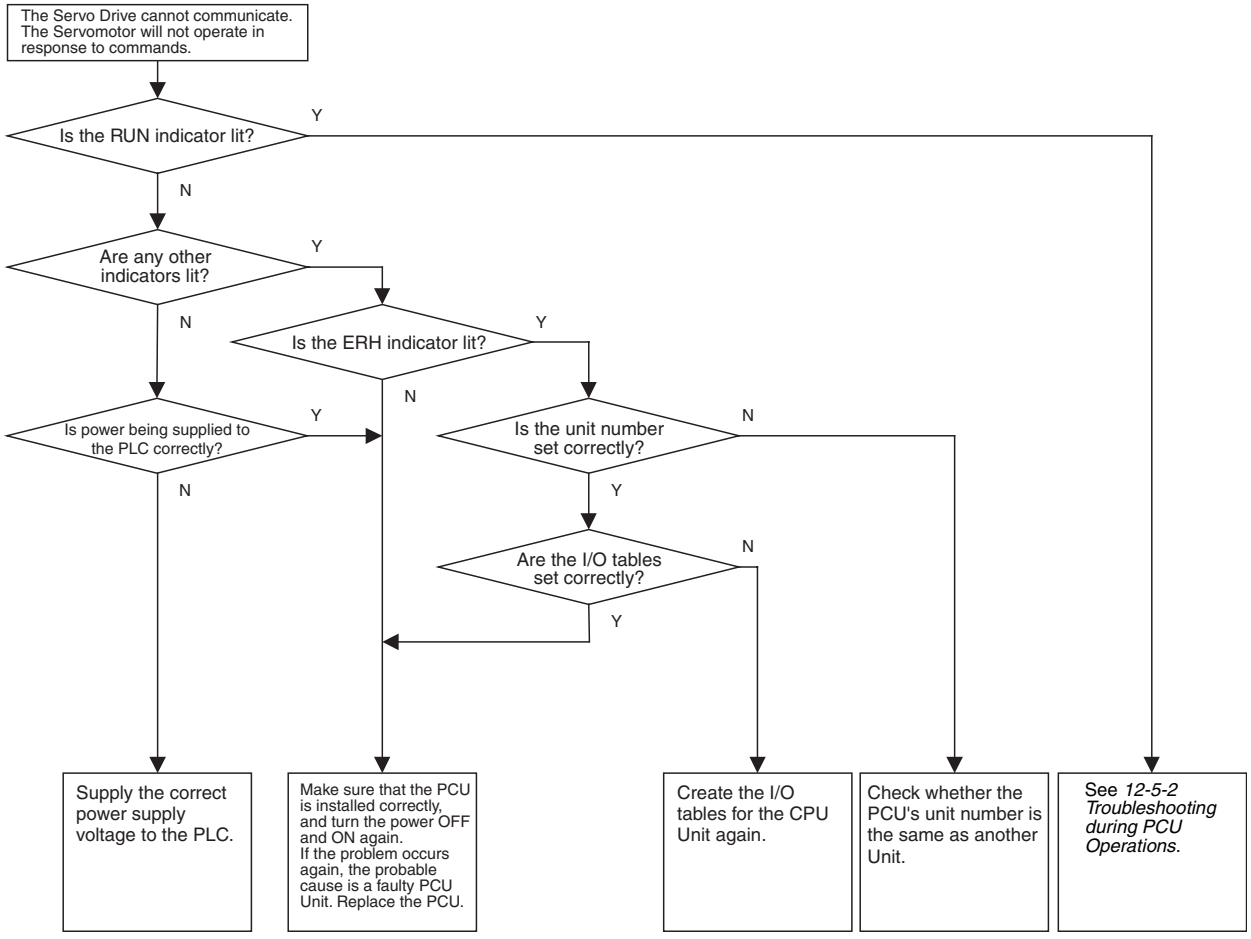
12-5 Troubleshooting

This section provides troubleshooting flowcharts when Servo Drive communications cannot be established or movement is not possible even when movement commands are sent from the ladder program.

12-5-1 Initial Troubleshooting

The following troubleshooting flowchart is for errors that occur during initial checking.

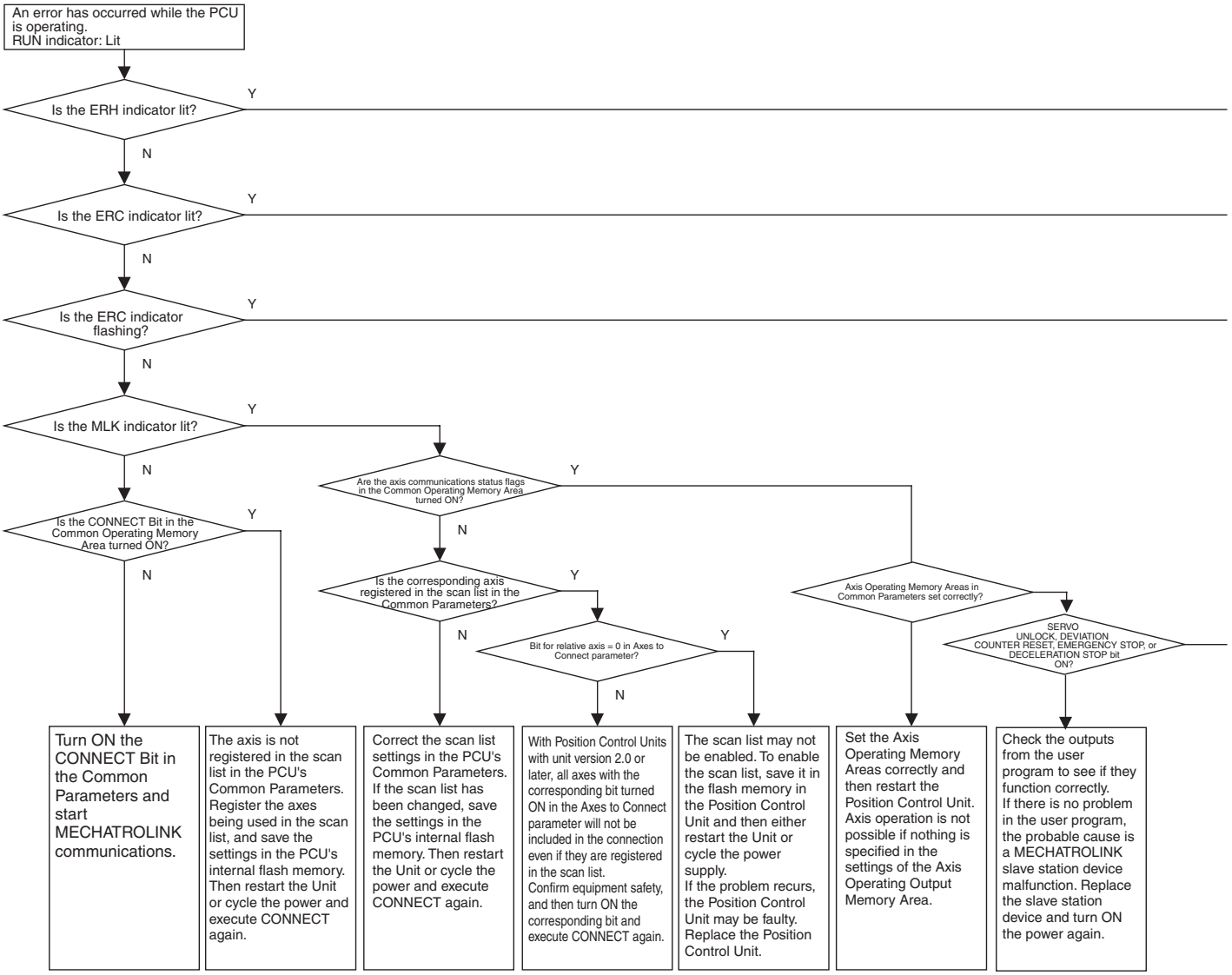
This flowchart can be used to determine whether the PCU is faulty and cannot be started.

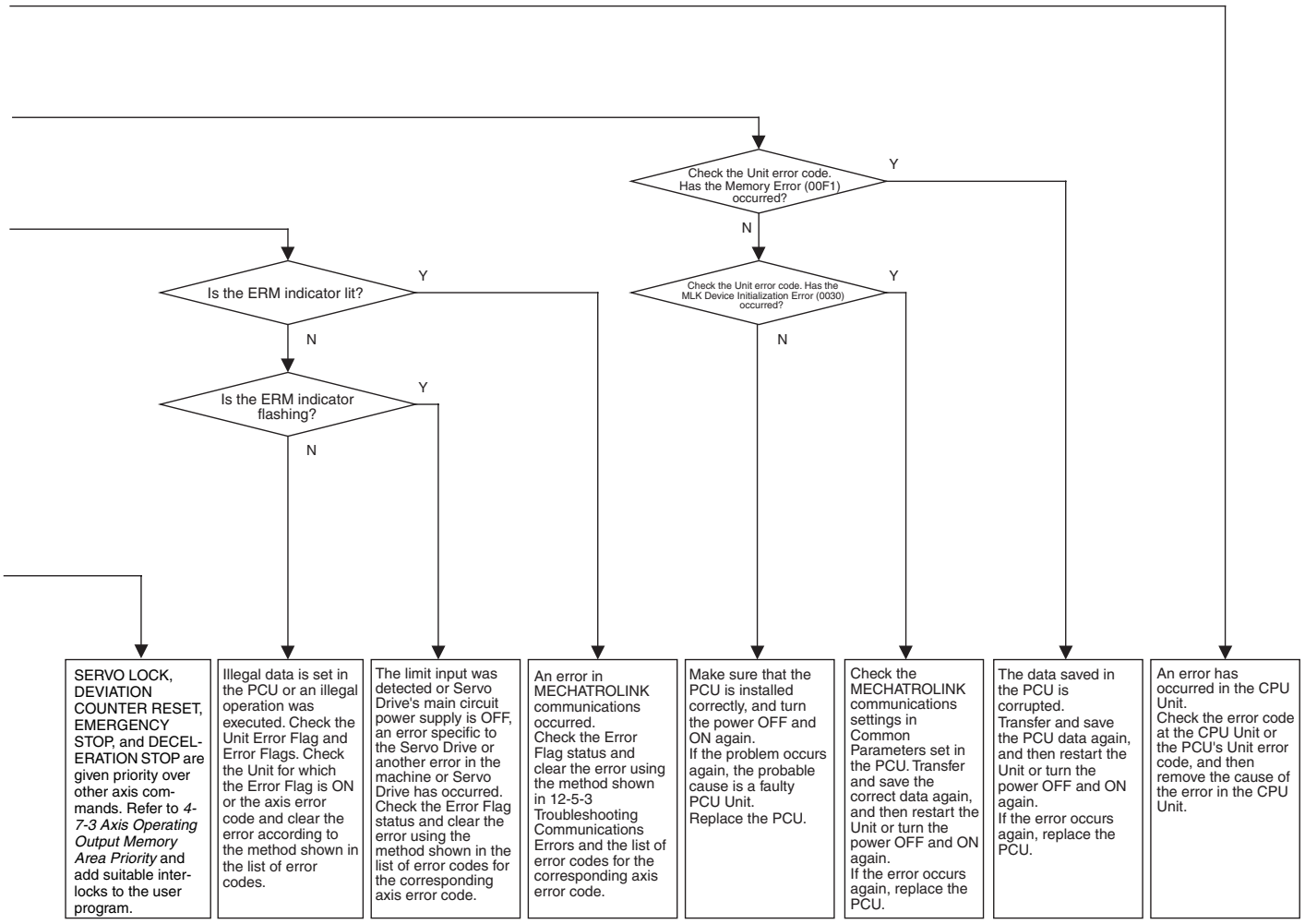

The Servo Drive cannot communicate. The Servomotor will not operate in response to commands.
Is the RUN indicator lit?
Y
N
Are any other indicators lit?
Y
N
Is the ERH indicator lit?
Y
N
Is power being supplied to the PLC correctly?
Y
N
Is the unit number set correctly?
N
Y
Are the I/O tables set correctly?
N
Y
Supply the correct power supply voltage to the PLC.
Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the problem occurs again, the probable cause is a faulty PCU Unit. Replace the PCU.
Create the I/O tables for the CPU Unit again.
Check whether the PCU's unit number is the same as another Unit.
See *12-5-2 Troubleshooting during PCU Operations*.

12-5-2 Troubleshooting during PCU Operations

The following troubleshooting flowchart is for problems that occur after the PCU has been started (RUN indicator is lit).

Use this flowchart to determine whether the error is a CPU Unit error, a setting or usage problem, or a MECHATROLINK communications error.

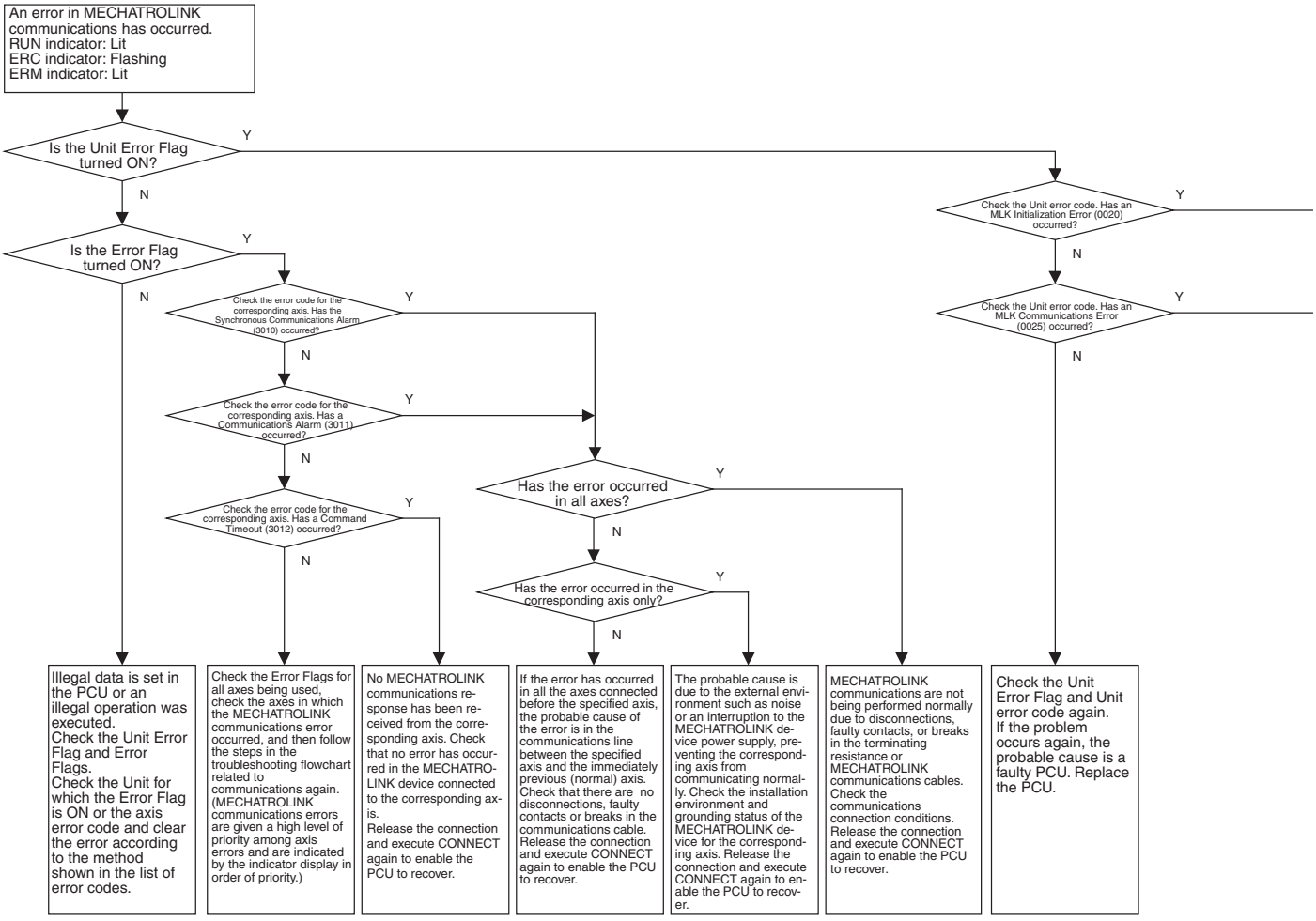

An error has occurred while the PCU is operating.
RUN indicator: Lit
Is the ERH indicator lit?
Y
N
Is the ERC indicator lit?
Y
N
Is the ERC indicator flashing?
Y
N
Is the MLK indicator lit?
Y
N
Is the CONNECT Bit in the Common Operating Memory Area turned ON?
Y
N
Are the axis communications status flags in the Common Operating Memory Area turned ON?
Y
N
Is the corresponding axis registered in the scan list in the Common Parameters?
Y
N
Bit for relative axis = 0 in Axes to Connect parameter?
Y
N
Axis Operating Memory Areas in Common Parameters set correctly?
SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, or DECELERATION STOP bit ON?
Turn ON the CONNECT Bit in the Common Parameters and start MECHATROLINK communications.
The axis is not registered in the scan list in the PCU's Common Parameters. Register the axes being used in the scan list, and save the settings in the PCU's internal flash memory. Then restart the Unit or cycle the power and execute CONNECT again.
Correct the scan list settings in the PCU's Common Parameters. If the scan list has been changed, save the settings in the PCU's internal flash memory. Then restart the Unit or cycle the power and execute CONNECT again.
With Position Control Units with unit version 2.0 or later, all axes with the corresponding bit turned ON in the Axes to Connect parameter will not be included in the connection even if they are registered in the scan list. Confirm equipment safety, and then turn ON the corresponding bit and execute CONNECT again.
The scan list may not be enabled. To enable the scan list, save it in the flash memory in the Position Control Unit and then either restart the Unit or cycle the power supply. If the problem recurs, the Position Control Unit may be faulty. Replace the Position Control Unit.
Set the Axis Operating Memory Areas correctly and then restart the Position Control Unit. Axis operation is not possible if nothing is specified in the settings of the Axis Operating Output Memory Area.
Check the outputs from the user program to see if they function correctly. If there is no problem in the user program, the probable cause is a MECHATROLINK slave station device malfunction. Replace the slave station device and turn ON the power again.

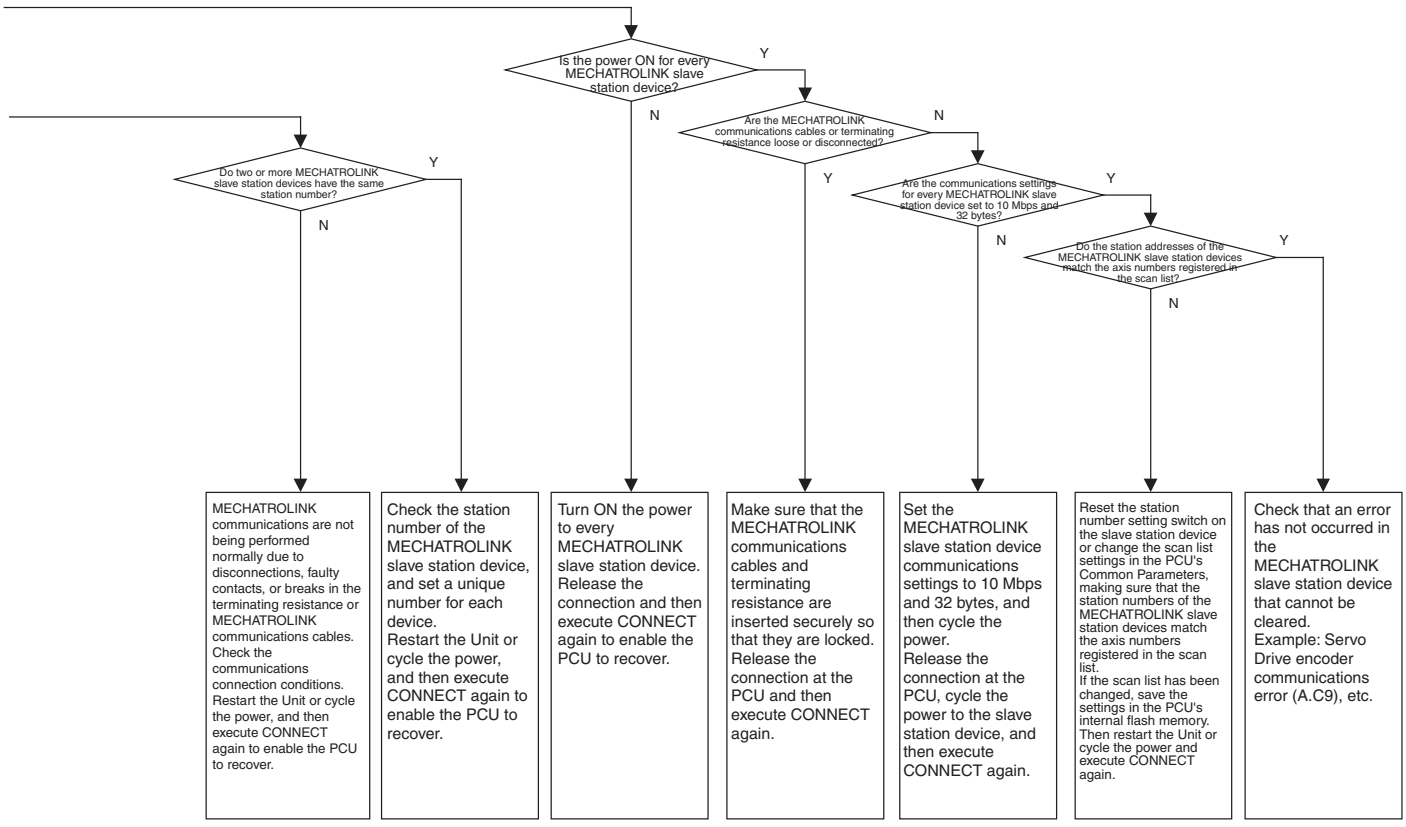

Check the Unit error code. Has the Memory Error (00F1) occurred?
Y
N
Check the Unit error code. Has the MLK Device Initialization Error (0030) occurred?
Y
N
Is the ERM indicator lit?
Y
N
Is the ERM indicator flashing?
Y
N
SERVO LOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, and DECELERATION STOP are given priority over other axis commands. Refer to *4-7-3 Axis Operating Output Memory Area Priority* and add suitable interlocks to the user program.
Illegal data is set in the PCU or an illegal operation was executed. Check the Unit Error Flag and Error Flags. Check the Unit for which the Error Flag is ON or the axis error code and clear the error according to the method shown in the list of error codes.
The limit input was detected or Servo Drive's main circuit power supply is OFF, an error specific to the Servo Drive or another error in the machine or Servo Drive has occurred. Check the Error Flag status and clear the error using the method shown in the list of error codes for the corresponding axis error code.
An error in MECHATROLINK communications occurred. Check the Error Flag status and clear the error using the method shown in 12-5-3 Troubleshooting Communications Errors and the list of error codes for the corresponding axis error code.
Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the problem occurs again, the probable cause is a faulty PCU Unit. Replace the PCU.
Check the MECHATROLINK communications settings in Common Parameters set in the PCU. Transfer and save the correct data again, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU.
The data saved in the PCU is corrupted. Transfer and save the PCU data again, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU.
An error has occurred in the CPU Unit. Check the error code at the CPU Unit or the PCU's Unit error code, and then remove the cause of the error in the CPU Unit.

12-5-3 Troubleshooting Communications Errors

The following troubleshooting flowchart is for when MECHATROLINK communications errors occur.

Use this flowchart to determine the cause, such as whether the error is due to MECHATROLINK communications settings or installation.


An error in MECHATROLINK communications has occurred.
RUN indicator: Lit
ERC indicator: Flashing
ERM indicator: Lit
Is the Unit Error Flag turned ON?
Y
N
Is the Error Flag turned ON?
Y
N
Check the error code for the corresponding axis. Has the Synchronous Communications Alarm (3010) occurred?
Y
N
Check the error code for the corresponding axis. Has a Communications Alarm (3011) occurred?
Y
N
Check the error code for the corresponding axis. Has a Command Timeout (3012) occurred?
Y
N
Has the error occurred in all axes?
Y
N
Has the error occurred in the corresponding axis only?
Y
N
Check the Unit error code. Has an MLK Initialization Error (0020) occurred?
Y
N
Check the Unit error code. Has an MLK Communications Error (0025) occurred?
Y
N
Illegal data is set in the PCU or an illegal operation was executed.
Check the Unit Error Flag and Error Flags.
Check the Unit for which the Error Flag is ON or the axis error code and clear the error according to the method shown in the list of error codes.
Check the Error Flags for all axes being used, check the axes in which the MECHATROLINK communications error occurred, and then follow the steps in the troubleshooting flowchart related to communications again. (MECHATROLINK communications errors are given a high level of priority among axis errors and are indicated by the indicator display in order of priority.)
No MECHATROLINK communications response has been received from the corresponding axis. Check that no error has occurred in the MECHATROLINK device connected to the corresponding axis.
Release the connection and execute CONNECT again to enable the PCU to recover.
If the error has occurred in all the axes connected before the specified axis, the probable cause of the error is in the communications line between the specified axis and the immediately previous (normal) axis. Check that there are no disconnections, faulty contacts or breaks in the communications cable.
Release the connection and execute CONNECT again to enable the PCU to recover.
The probable cause is due to the external environment such as noise or an interruption to the MECHATROLINK device power supply, preventing the corresponding axis from communicating normally. Check the installation environment and grounding status of the MECHATROLINK device for the corresponding axis. Release the connection and execute CONNECT again to enable the PCU to recover.
MECHATROLINK communications are not being performed normally due to disconnections, faulty contacts, or breaks in the terminating resistance or MECHATROLINK communications cables. Check the communications connection conditions.
Release the connection and execute CONNECT again to enable the PCU to recover.
Check the Unit Error Flag and Unit error code again.
If the problem occurs again, the probable cause is a faulty PCU. Replace the PCU.


Is the power ON for every MECHATROLINK slave station device?
Y
N
Are the MECHATROLINK communications cables or terminating resistance loose or disconnected?
N
Y
Are the communications settings for every MECHATROLINK slave station device set to 10 Mbps and 32 bytes?
Y
N
Do the station addresses of the MECHATROLINK slave station devices match the axis numbers registered in the scan list?
Y
N
Do two or more MECHATROLINK slave station devices have the same station number?
Y
N
MECHATROLINK communications are not being performed normally due to disconnections, faulty contacts, or breaks in the terminating resistance or MECHATROLINK communications cables. Check the communications connection conditions. Restart the Unit or cycle the power, and then execute CONNECT again to enable the PCU to recover.
Check the station number of the MECHATROLINK slave station device, and set a unique number for each device. Restart the Unit or cycle the power, and then execute CONNECT again to enable the PCU to recover.
Turn ON the power to every MECHATROLINK slave station device. Release the connection and then execute CONNECT again to enable the PCU to recover.
Make sure that the MECHATROLINK communications cables and terminating resistance are inserted securely so that they are locked. Release the connection at the PCU and then execute CONNECT again.
Set the MECHATROLINK slave station device communications settings to 10 Mbps and 32 bytes, and then cycle the power. Release the connection at the PCU, cycle the power to the slave station device, and then execute CONNECT again.
Reset the station number setting switch on the slave station device or change the scan list settings in the PCU's Common Parameters, making sure that the station numbers of the MECHATROLINK slave station devices match the axis numbers registered in the scan list. If the scan list has been changed, save the settings in the PCU's internal flash memory. Then restart the Unit or cycle the power and execute CONNECT again.
Check that an error has not occurred in the MECHATROLINK slave station device that cannot be cleared. Example: Servo Drive encoder communications error (A.C9), etc.

12-6 Error Reset

The PCU indicates Unit common errors and individual axis errors in the Common Operating Memory Area and Axis Operating Input Memory Areas, respectively, using Error Flags and error codes.

These errors can be cleared by removing the cause of the error and executing ERROR RESET.

The methods for resetting Unit common errors and individual axis errors are different.

12-6-1 Resetting Unit Common Errors

Unit common errors are cleared by turning ON (↓) the UNIT ERROR RESET Bit in the Common Operating Memory Area.

Reset Unit common errors when the Unit Busy Flag for the Position Control Unit is OFF. If errors are reset when the Unit Busy Flag is ON, a multistart error (Unit error code: 0021) will occur and it will not be possible to reset Unit common errors.

When clearing Unit common errors, make sure that the UNIT ERROR RESET Bit in the Common Operating Memory Area remains ON until the Unit Busy Flag turns ON.

Common Operating Memory Area (Output)

Name	Word	Bit	Contents
UNIT ERROR RESET Bit	n	00	↓: Resets Unit common error

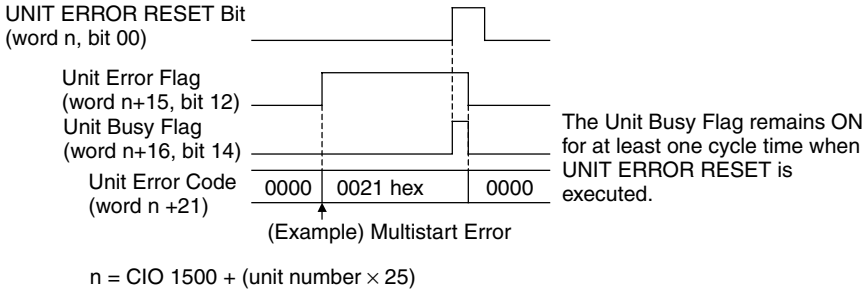
n = CIO 1500 + (unit number × 25)

Common Operating Memory Area (Input)

Name	Word	Bit	Contents
Unit Error Flag	n+15	12	0: Unit common error has not occurred. 1: Unit common error has occurred.
Unit Busy Flag	n+16	14	0: PCU is not busy 1: PCU is busy
Unit error code	n+21	---	Stores the error code when a Unit common error occurs.

n = CIO 1500 + (unit number × 25)

Timing Chart Example for UNIT ERROR RESET


UNIT ERROR RESET Bit
(word n, bit 00)
Unit Error Flag
(word n+15, bit 12)
Unit Busy Flag
(word n+16, bit 14)
Unit Error Code
(word n +21)
0000
0021 hex
0000
The Unit Busy Flag remains ON for at least one cycle time when UNIT ERROR RESET is executed.
(Example) Multistart Error

n = CIO 1500 + (unit number × 25)

12-6-2 Resetting Individual Axis Errors and Warnings

Individual axis errors/warnings are cleared by turning ON (↑) the ERROR RESET Bits in the Axis Operating Output Memory Areas.

Reset individual axis errors and warning when the Axis Busy Flag for the Axis is OFF. If errors are reset when the Axis Busy Flag is ON, a multistart error (Axis error code: 3050) will occur and it will not be possible to reset errors/warnings.

When clearing individual axis errors/warnings, make sure that the ERROR RESET Bit remains ON until the Busy Flag in the Axis Operating Input Memory Areas turns ON.

Axis Operating Output Memory Areas

Name	Word	Bit	Contents
ERROR RESET Bit	a	12	↑: Resets axis error

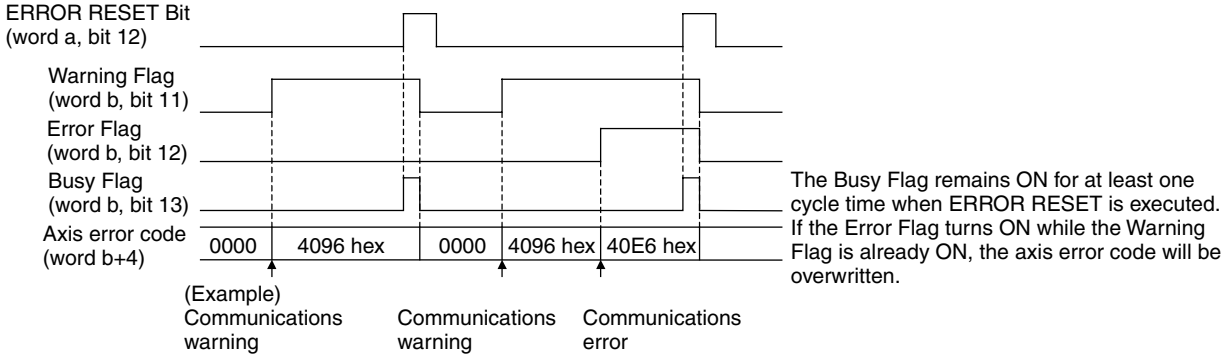
a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

Axis Operating Input Memory Areas

Name	Word	Bit	Contents
Warning Flag	b	11	0: No warning 1: Warning has occurred
Error Flag		12	0: No error 1: Error has occurred
Busy Flag		13	1: Axis busy (AXIS ERROR RESET executing)
Axis error code	b+4	---	Stores the error code for the error that occurred in an individual axis.

b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. −1) × 25

Timing Chart Example for ERROR RESET


ERROR RESET Bit
(word a, bit 12)
Warning Flag
(word b, bit 11)
Error Flag
(word b, bit 12)
Busy Flag
(word b, bit 13)
Axis error code
(word b+4)
0000
4096 hex
0000
4096 hex
40E6 hex
(Example)
Communications warning
Communications warning
Communications error
The Busy Flag remains ON for at least one cycle time when ERROR RESET is executed. If the Error Flag turns ON while the Warning Flag is already ON, the axis error code will be overwritten.

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. − 1) × 25
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. − 1) × 25

12-6-3 Restarting the PCU

For errors that cannot be cleared using ERROR RESET, remove the cause of the error and either cycle the power to the CPU Unit or restart the CPU Bus Unit to enable the PCU to recover from the error.

Name	Word	Details	Read/write
CPU Bus Unit Restart Flag	A50100 to A50115	The CPU Bus Unit is restarted when this flag is set from 0 to 1. Each bit corresponds to the unit number. Bits 00 to 15: Unit numbers 0 to F	Read/write possible

12-7 CPU Unit Error Display

The CPU Unit monitors the PCU, which is a CPU Bus Unit, as follows:

- Monitors PCU for hardware errors
- Monitors unit number duplication
- Monitors refreshing between the CPU Unit and PCU.

If an error is detected during the above monitoring operations, the corresponding flag in the Auxiliary Area of the CPU Unit will turn ON (for details on each flag, refer to the CPU Unit's operation manual). The flags are as follows:

- CPU Bus Unit Number Duplication Flags (A41000 to A41015)
- CPU Bus Unit Error, Unit Number Flags (A41700 to A41715)
- CPU Bus Unit Setting Error, Unit Number Flags (A42700 to A42715)
- CPU Bus Unit Setting Error Flag (A40203)
- CPU Bus Unit Error Flag (A40207)

Perform error processing according to the tables provided in *12-3 LED Error Indicators* and *12-4-2 List of Error Codes*.

SECTION 13
Maintenance and Inspection

This section describes methods for inspecting and maintaining the Position Control Unit and the procedure required to replace a Position Control Unit.

13-1 Inspection 486
13-2 Inspection Points 486
13-3 Handling Precautions 487
13-4 Procedure for Replacing a PCU 487
13-4-1 Procedure for Replacing a PCU 487
13-4-2 Memory Card Backup 488

13-1 Inspection

Perform daily or periodic inspections to make sure that the PCU continues operating in its optimum condition.

13-2 Inspection Points

The main components of the PCU are semiconductors, which have a long service life. These components may deteriorate faster, however, due to factors such as the operating environment. Therefore, routine inspection is required.

The standard inspection schedule is once every six months to one year. More frequent inspections may be advisable depending on the operating environment.

Maintain the inspection schedule once it has been set.

Routine Inspection Points

No.	Inspection point	Details	Criteria	Remarks
1	I/O Power Supply	Measure the voltage variations at the I/O power supply terminal block. Do they meet the standards?	24 V DC: 21.6 to 26.4 V DC	Using a voltage tester, check between the terminals adjusting to make sure that the power supply is within the acceptable range.
2	Environment conditions	Is the ambient temperature within the acceptable range? (When used in a panel, the ambient temperature of the PCU inside the panel must be checked.)	0 to 55°C	Using a thermometer, check the ambient temperature inside the panel and make sure that it is within the acceptable range.
		Is the ambient humidity (humidity within panel) within the acceptable range? (When used in a panel, the ambient humidity of the PCU inside the panel must be checked.)	10% to 90% (with no condensation)	Using a hygrometer, check the ambient humidity inside the panel and make sure that it is within the acceptable range. In particular, check that there is no condensation due to sudden changes in temperature.
		Is the PCU exposed to direct sunlight?	The PCU must not be exposed to direct sunlight.	Shield the PCU from direct sunlight.
		Is there any accumulation of dust (including iron dust) or salts?	There must be none of these present.	Remove any accumulation of dust (including iron dust) or salts and protect the PCU against them.
		Is the PCU exposed to any sprays of water, oil, or chemicals?	The PCU must not be exposed to any of these.	Protect the PCU against water, oil, and chemicals.
		Is the PCU installed in a location subject to corrosive or flammable gases?	The PCU must not be exposed to any of these.	Check for odors by smelling or using a gas sensor.
		Is the PCU installed in a location subject to shock or vibration?	The amount of shock or vibration must be within the acceptable ranges given in the specifications.	Install a cushion or other device to reduce shock and vibration.
		Is the PCU installed in a location near any source of noise?	There must be no noise.	Remove the PCU from the noise source or take countermeasures to protect the PCU from noise.
3	Installation and wiring	Is the PCU securely mounted?	The mounting must not be loose.	Lock the sliders securely.
		Are the cable connectors properly inserted and locked?	The mounting must not be loose.	Insert and lock all cable connectors properly.
		Are any external cables disconnected?	There must be no external abnormalities.	Do a visual check and connect or replace cables as required.

Required Inspection Tools

The following tools, materials, and equipment are required for performing inspections.

- Voltage tester or digital voltage meter
- Industrial alcohol and a clean cotton cloth

The following measuring devices may be required when performing an inspection.

- Oscilloscope
- Memory recorder
- Thermometer
- Hygrometer

13-3 Handling Precautions

- Turn OFF the power before replacing the PCU.
- If a PCU is found to be faulty and is replaced, also check the new PCU to make sure that there are no errors.
- When returning a faulty PCU for repair, make a detailed record of the PCU's malfunction and take it together with the PCU to your nearest OMRON office or sales representative.
- If a contact is faulty, clean the contact by applying some industrial alcohol to a clean cotton cloth and wiping the surface, and then install the PCU.

13-4 Procedure for Replacing a PCU

Use the following procedure when it is necessary to replace a PCU due to malfunction or other cause. The method for backing up data saved in the PCU's internal flash memory is also provided here.

13-4-1 Procedure for Replacing a PCU

Use the following procedure to replace a PCU.

1,2,3...

1. Make a note of the unit number of the PCU to be replaced.
2. Use the READ DATA Bit to read the parameters saved in the PCU to be replaced to the PLC's DM Area first. Then save the DM Area data to a floppy disk or hard disk using, for example, CX-Programmer. Alternatively, use the CPU Unit's simple backup function or the PCU's backup function to back up (write) the PCU parameter data to the Memory Card installed in the CPU Unit.
3. Turn OFF the power to the CPU Unit.
4. Disconnect the MECHATROLINK-II communications cables that are connected to the Servo Drive.
5. Replace the PCU and reconnect the MECHATROLINK-II communications cables, making sure that they are securely locked.
6. Set the unit number for the PCU.
7. Turn ON the power supply to the CPU Unit.

8. Transfer the saved parameters and operating data to the CPU Unit's DM Area using, for example, CX-Programmer, and then transfer them to the PCU using the WRITE DATA Bit. After transferring, save the parameters and operating data to the flash memory. When the PCU's parameter data has been saved to the Memory Card using the CPU Unit's simple backup function or the PCU's backup function, execute the command to restore (read) the data from the Memory Card. Save the backed up parameters to the PCU's flash memory by reading them from the Memory Card.
9. Turn OFF the power supply to the CPU Unit, and then turn it ON again.

For details on transferring PCU data to the Memory Card installed in the CPU Unit, refer to the next section *13-4-2 Memory Card Backup*.

Note The above procedure is used when replacing the PCU, and transferring only the parameters saved in the PCU. This procedure is not used to transfer Servo Parameters saved in the Servo Drive.
When replacing the Servo Drive, use the PCU's READ SERVO PARAMETER Bit to read the parameters saved in the Servo Drive to be replaced to the CPU Unit's DM Area first. Then save the DM Area data to a floppy disk or hard disk using, for example, CX-Programmer. After replacing the Servo Drive, transfer the saved Servo Parameters to the CPU Unit's DM Area using, for example, CX-Programmer, and then write them to the Servo Drive's non-volatile memory using the PCU's SAVE SERVO PARAMETER Bit.

13-4-2 Memory Card Backup

The following data can be saved to the PCU's internal flash memory.

- Common Parameters
- Axis Parameters

The PCU can save this data to the Memory Card installed in the CPU Unit by using the CPU Unit's simple backup function or the PCU's backup function. The data saved to the Memory Card can also be read to the PCU's flash memory.

Note Do not read out data backed up to a Memory Card installed in the CPU Unit from a Position Control Unit with unit version 1.0 to a Position Control Unit with unit version 1.1 or later (for both the simple backup function and the PCU's backup function). If Position Control Unit Ver. 1.0 backup data is restored for Position Control Unit Ver. 1.1 or later, the linear interpolation function will be disabled. To transfer setting data from Position Control Unit Ver. 1.0 to Position Control Unit Ver. 1.1 or later, use the parameter transfer function using the data transfer bits (WRITE DATA, READ DATA, and SAVE DATA) in the Common Operating Memory Area.

CPU Unit's Simple Backup Function

CS/CJ-series CPU Units have a simple backup function that enables all the setup data in the CPU Unit for every Unit to be backed up (written) to the Memory Card that is installed in the CPU Unit or restored (read) from the Memory Card at the same time by simply operating a switch on the front of the CPU Unit.

When replacing the PCU, the time required to reset each Unit can be shortened by reading the backup file.

The CJ1W-NC□71/CS1W-NC□71 PCUs described in this manual support the CS/CJ-series CPU Unit simple backup function.

Note The simple backup function can be used to back up the PCU's Common Parameters and Axis Parameters. The Servo Parameters for each Servo Drive connected to the PCU will not be saved to the Memory Card.

The PCU data backed up using the CPU Unit's simple backup function is stored in the Memory Card under the following filename.

File name: BACKUP□□.PRM
(**Note:** The boxes indicate the PCU's unit number + 10 hex)

For details on the CPU Unit's simple backup function, refer to *5-2-6 Simple Backup Function* in the *CS/CJ-series Programmable Controllers Programming Manual* (W394).

Note The CPU Unit's simple backup function is used to backup or restore data for the entire CPU Unit's system at the same time. Changing the system configuration may prevent restoration of the PCU's data. To backup or restore data for a single PCU, use the PCU's backup function as described next.

PCU's Backup Function

The PCU has a backup function for separately transferring data that has been saved in the PCU's internal flash memory to the Memory Card installed in the CPU Unit using the READ BACKUP DATA Bit and WRITE BACKUP DATA Bit in the Common Operating Memory Area.

The PCU's backup function can be executed while MECHATROLINK communications are stopped (connection released) and the Unit Busy Flag is OFF. If this command is executed during MECHATROLINK communications, the command will be ignored and backup will not be performed.

Writing and reading of backup data starts at the rising edge (↑) when the WRITE BACKUP DATA Bit and READ BACKUP DATA Bit turn ON, respectively, in the Common Operating Memory Area.

Common Operating Memory Area (Output)

Name	Word	Bit	Contents
WRITE BACKUP DATA	n+1	06	↑: Starts writing backup data
READ BACKUP DATA		07	↑: Starts reading backup data

n = CIO 1500 + (unit number × 25)

When executing the PCU's backup function, make sure that the WRITE BACKUP DATA Bit or READ BACKUP DATA Bit remains ON until the Unit Busy Flag turns ON.

The Unit Busy Flag is ON while data is being transferred between the PCU and Memory Card. When transferring data is completed, the Unit Busy Flag turns OFF.

Common Operating Memory Area (Input)

Name	Word	Bit	Contents
Memory Card Transfer Error Flag	n+16	12	0: No Memory Card transfer error 1: A Memory Card transfer error has occurred
Unit Busy Flag		14	0: PCU is not busy 1: PCU is busy

n = CIO 1500 + (unit number × 25)

If an error occurs in transferring data between the PCU and Memory Card when using the PCU's backup function, the data transfer will be cancelled, and the Memory Card Transfer Error Flag in the Common Operating Memory Area will turn ON.

If a Memory Card Transfer Error occurs, execute UNIT ERROR RESET and after the error is reset, execute the backup function again.

The PCU data backed up using the PCU's backup function is stored in the Memory Card under the following filename.

File name: UNIT□□.PRM
(**Note:** The boxes indicate the PCU's unit number + 10 hex)

Note

(1) Execute PCU's READ BACKUP DATA to restore (read) data from the Memory Card to the PCU's internal flash memory. The data restored in the internal flash memory is enabled by restarting the PCU or cycling the power to the CPU Unit.

(2) If a Memory Card Transfer Error occurs while using the PCU's backup function, the backup to the Memory Card or restoration of data to the PCU's internal flash memory will not be executed correctly. If such an error occurs, always execute the backup function again, and backup or restore the correct data.

Appendix A
Performance Characteristics

The performance characteristics of the CJ1W-NCF71 are described here.

Refer to these characteristics when building applications.

The numerical values for each performance characteristic are obtained using the following machines and configuration.

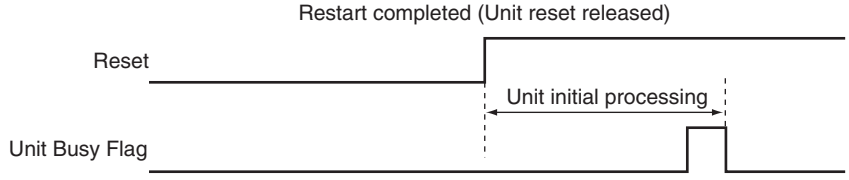
CPU Unit:	CJ1H-CPU□□H (without an Expansion Rack)
Position Control Unit:	A single PCU installed on the CPU Rack.
Servo Drive:	R88D-WT01HL Servo Drive equipped with a JUSP-NS115 MECHATROLINK-II Application Module

Note The performance values shown in this Appendix will depend on conditions such as the CPU Unit, user program, and other installed Units used. Therefore, these values are for reference purposes only.

Power Up Time

When the PCU is powered up or restarted, the time required for the Unit to complete its initial processing and be ready to receive commands from the CPU Unit is 500 ms max.

The Unit Busy Flag turns ON during initial processing after turning ON the PCU power or restarting the Unit.



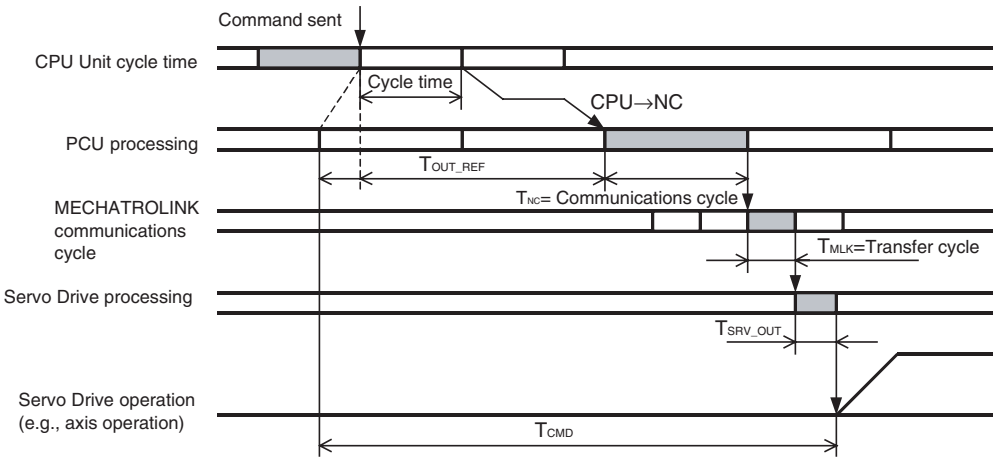
Command Response Time

The PCU's command response time is the time from when the CPU Unit (user program) sends a command to the PCU until the Servo Drive actually starts operating in response to the command, and the changes in Servo Drive, such as the present position and statuses are reflected in the CPU Unit's user program.

The command response time depends on the CPU Unit's cycle time, MECHATROLINK's transfer time and communications cycle, and the command processing time of MECHATROLINK slave station device.

Servo Drive's Response Time for Commands from the CPU Unit

The response time starts with refreshing outputs for the cycle in which the command was sent from the CPU Unit and continues until the Servo Drive starts operating in response to the command.



The maximum time from the end refresh of the user program's cycle in which the command was sent until the command is actually received by the PCU is indicated as T_{OUT_REF}:

(CPU cycle time or MECHATROLINK communications cycle, whichever is longer) + communications cycle × 1

The PCU processing time from when the command is received by the PCU until it is sent using MECHATROLINK communications is indicated as T_{NC}:

MECHATROLINK communications cycle × 1

Note If a warning occurs, PCU retry processing is required, so the value for T_{NC} is the MECHATROLINK communications cycle × 3.

The time for a command sent from the PCU using MECHATROLINK communications to reach the Servo Drive is indicated as T_{MLK}:

MECHATROLINK transfer cycle × 1

The processing time until execution of the command received by the Servo Drive is indicated as T_{SRV_OUT}:

250 μs (using an R88D-GN□-ML2 to send commands relating to interpolation feed, speed control and torque control)

1,250 μs (using an R88D-GN□-ML2 to send commands other than those described above)

625 μs (using an R88D-WT□ and JUSP-NS115 or the SMARTSTEP Junior)

425 μs (using an R88D-WN□-ML2)

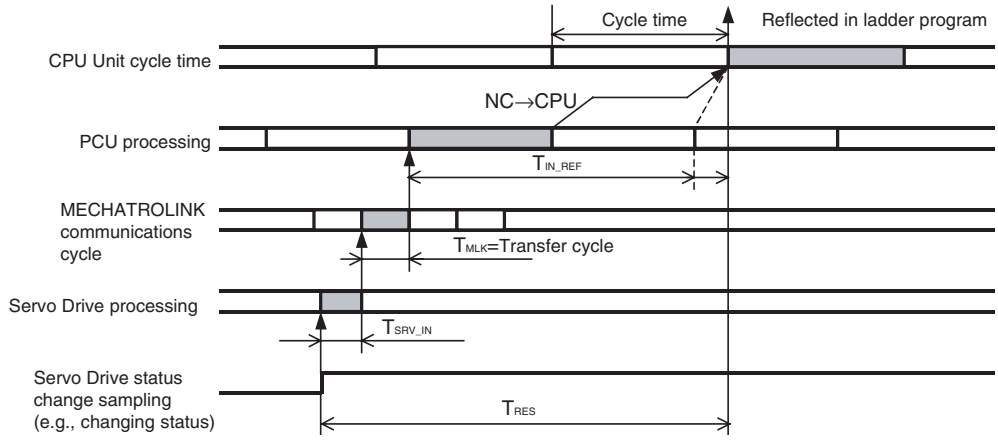
The maximum value for the time until the Servo Drive actually starts operating in response to the command sent from the CPU Unit's user program, as indicated by T_{CMD}, is calculated as the total of these values, as follows:

$T_{CMD(MAX)} = T_{OUT\_REF} + T_{NC} + T_{MLK} + T_{SRV\_OUT}$

Note T_{CMD} varies depending on the width of T_{OUT_REF}.

Response Time to Reflect Servo Drive Status Changes in CPU Unit

The response time starts when status transmitted via MECHATROLINK communications is sampled and continues until that status is refreshed in the CPU Unit's input status.



The processing time for the changes in status detected in the Servo Drive to be sent using MECHATROLINK communications is indicated as T_{SRV_IN}:

250 μs + transfer cycle (using R88D-GN□-ML2)

625 μs (using an R88D-WT□ and JUSP-NS115 MECHATROLINK-II Application Module or the SMARTSTEP Junior)

450 μs (using an R88D-WN□-ML2)

The time for the Servo Drive status to reach the PCU via MECHATROLINK communications is indicated as T_{MLK}:

MECHATROLINK transfer cycle × 1

The maximum time from the end refresh of the user program's cycle in which the command was sent until the command is actually received by the PCU is T_{IN_REF}:

(CPU cycle time or MECHATROLINK communications cycle, whichever is longer) + CPU Unit's cycle time × 1

The maximum value for the time until changes in the Servo Drive status are reflected in the CPU Unit's user program, as indicated by T_{RES}, is a total of these values, as follows:

$T_{RES(MAX)} = T_{SRV\_IN} + T_{MLK} + T_{IN\_REF}$

Note T_{RES} varies depending on the width of T_{IN_REF}.

Example:
CPU Unit cycle time: 1 ms
PCU communications setting: Transfer cycle: 1 ms
Communications cycle = 1 (transfer cycle × 1 = 1 ms)
Connected Servo Drive: W-series Servo Drive + JUSP-NS115

The command response time for the above conditions is as follows:

(This example applies when no warning has occurred in the PCU.)

Item	Maximum response time	Calculation method
CPU Unit to PCU	4.625 ms	$T_{CMD(MAX)} = T_{OUT\_REF} + T_{NC} + T_{MLK} + T_{SRV\_OUT}$ = 2 ms + 1 ms + 1 ms +625 μs
PCU to CPU Unit	3.625 ms	$T_{RES(MAX)} = T_{SRV\_IN} + T_{MLK} + T_{IN\_REF}$ = 625 μs + 1 ms + 2 ms

Note When mounting a Position Control Unit to a CS-series Long-distance Expansion Rack, refer to the graph on I/O refresh time coefficients in the *CS-series CPU Unit Operation Manual* (Cat. No. W339).

Effect on CPU Unit Cycle Time

When a single PCU is mounted, the CPU Unit's cycle time increases with the amount of Servo Drive axes connected to the PCU, as follows:

Model	Number of axes connected	Additional time for each PCU connected
CJ1W-NCF71	1	0.2 ms
	3	0.3 ms
	6	0.4 ms
	16	1.0 ms

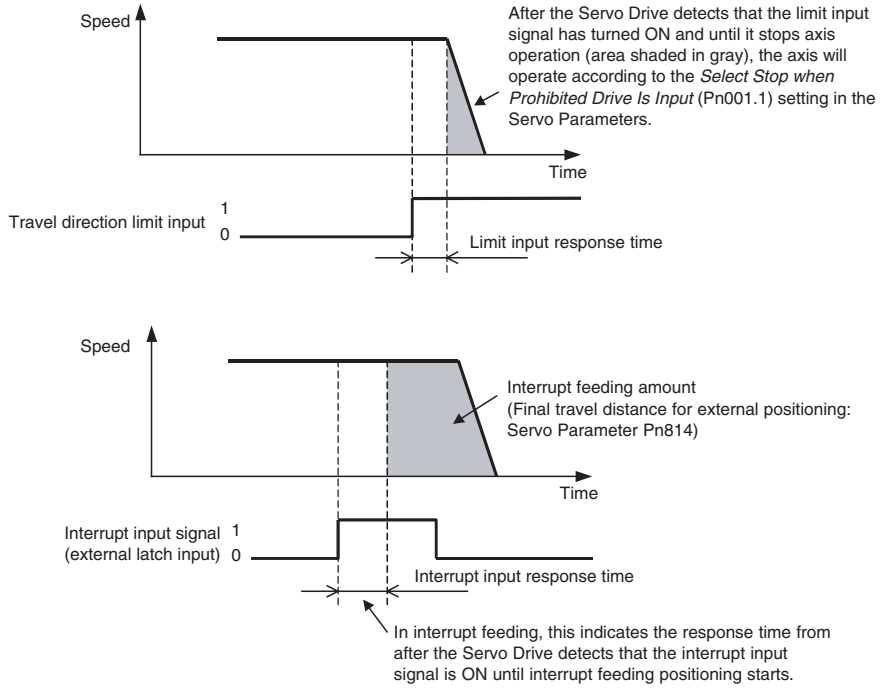
External Input Response Time

The response time is as shown below for external input signals, such as limit inputs and interrupt inputs. The following response times indicate the time until the Servo Drive starts operating according to the function corresponding to the input signal.

The command response time is required for the status of the signal that was input to be reflected in the input area of the CPU Unit.

External input signal	Response time	Details
Limit input signal	2 ms max.	Response time until the Servo Drive starts the Servomotor's stop operation according to the setting in Servo Parameter Pn001.1 in response to input of the limit input signal.
Interrupt input signal	3 ms max.	Response time until the interrupt feeding operation starts after input of the interrupt input signal for interrupt feeding.

Note The numerical values are obtained when a W-series Servo Drive is used with a JUSP-NS115 MECHATROLINK-II Application Module.


Speed
After the Servo Drive detects that the limit input signal has turned ON and until it stops axis operation (area shaded in gray), the axis will operate according to the *Select Stop when Prohibited Drive Is Input* (Pn001.1) setting in the Servo Parameters.
Time
Travel direction limit input
1
0
Limit input response time
Speed
Interrupt feeding amount
(Final travel distance for external positioning: Servo Parameter Pn814)
Time
Interrupt input signal (external latch input)
1
0
Interrupt input response time
In interrupt feeding, this indicates the response time from after the Servo Drive detects that the interrupt input signal is ON until interrupt feeding positioning starts.

Difference in Start Times for Simultaneously Started Axes

There is no difference in start times between axes when multiple axes are started at the same time (the bit to start operation turns ON at the same I/O refresh timing).

Appendix B
List of Parameters

Common Parameter Area

PCU's internal address	Name	Bit			
		15 to 12	11 to 08	07 to 04	03 to 00
1838 hex	Area allocations	Axis Operating Output Memory Area designation 0000 hex: No setting 00B0 hex: CIO Area 00B1 hex: WR Area 00B2 hex: HR Area 00B3 hex: AR Area 0082 hex: DM Area 0050 to 0059, 005A, 005B, 005C: EM Area (5□: □ = EM Bank No.)			
1839 hex		Beginning word of Axis Operating Output Memory Area: 0000 to 7FFF hex			
183A hex		Axis Operating Input Memory Area designation 0000 hex: No setting 00B0 hex: CIO Area 00B1 hex: WR Area 00B2 hex: HR Area 00B3 hex: AR Area 0082 hex: DM Area 0050 to 0059, 005A, 005B, 005C: EM Area (5□: □ = EM Bank No.)			
183B hex		Beginning word of Axis Operating Input Memory Area: 0000 to 7FFF hex			
183C hex	Scan list	Axis 2 allocation 00 hex: Axis not used (no allocation) 40 hex: Allocates axis to the Servo Drive.		Axis 1 allocation 00 hex: Axis not used (no allocation) 40 hex: Allocates axis to the Servo Drive.	
183D hex		Axis 4 allocation (same as above)		Axis 3 allocation (same as above)	
183E hex		Axis 6 allocation (same as above)		Axis 5 allocation (same as above)	
183F hex		Axis 8 allocation (same as above)		Axis 7 allocation (same as above)	
1840 hex		Axis 10 allocation (same as above)		Axis 9 allocation (same as above)	
1841 hex		Axis 12 allocation (same as above)		Axis 11 allocation (same as above)	
1842 hex		Axis 14 allocation (same as above)		Axis 13 allocation (same as above)	
1843 hex		Axis 16 allocation (same as above)		Axis 15 allocation (same as above)	
1844 hex to 1855 hex	Reserved by the system.	0	0	0	0
1856 hex	MECHATROLINK communications setting	Transfer cycle 00: 1 ms (default setting) 01: 1 ms 02: 2 ms 03: 3 ms 04: 4 ms 05: 5 ms 06: 6 ms 07: 7 ms 08: 8 ms A2 hex: 0.25 ms A5 hex: 0.5 ms		Communications cycle Sets the factor used as the integer multiple for the transfer cycle. Set value: 00 to 20 hex The default setting 00 is the same as when the cycle is set to 3.	
1857 hex		0	0	C2 Master Connection 0: No C2 master (default setting) 1: C2 master connected	Number of communications retries Set value: 0 to 7, F hex
1858 hex to 185F hex	Reserved by the system.	0	0	0	0

Axis Parameter Area

Beginning word of Axis Parameter Area for Axis N: d = 1860 hex + (N − 1) × 14 hex (N = 1 to 16)

PCU's internal address (hexadecimal)																Data
Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**	**Axis 7**	**Axis 8**	**Axis 9**	**Axis 10**	**Axis 11**	**Axis 12**	**Axis 13**	**Axis 14**	**Axis 15**	**Axis 16**	
1860	1874	1888	189C	18B0	18C4	18D8	18EC	1900	1914	1928	193C	1950	1964	1978	198C	Input signal selection
1861	1875	1889	189D	18B1	18C5	18D9	18ED	1901	1915	1929	193D	1951	1965	1979	198D	Operation mode selection

Input signal selection

Bit	Function	Settings
00 to 07	Interrupt input signal selection	00: Phase Z 01: External latch signal 1 input 02: External latch signal 2 input 03: External latch signal 3 input
08 to 15	Origin input signal selection	00: Phase Z 01: External latch signal 1 input 02: External latch signal 2 input 03: External latch signal 3 input

Operation mode selection

Bit	Function	Settings
00 to 03	Reserved by the system.	0
04 to 07	Origin search operation	0: Reversal mode 1 1: Reversal mode 2 2: Single-direction mode 3: Reversal mode 3 (See note.)
08 to 11	Origin detection method (See note.)	0: Origin proximity input signal reversal 1: No origin proximity input signal reversal 2: Do not use origin proximity input signal
12	Origin search direction	0: Forward 1: Reverse
13	Origin search preset (See note.)	0: Not set. 1: Set.
14 to 15	Reserved by the system.	0

PCU's internal address (hexadecimal)																Data
Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**	**Axis 7**	**Axis 8**	**Axis 9**	**Axis 10**	**Axis 11**	**Axis 12**	**Axis 13**	**Axis 14**	**Axis 15**	**Axis 16**	
1862	1876	188A	189E	18B2	18C6	18DA	18EE	1902	1916	192A	193E	1952	1966	197A	198E	Operation mode selection **Bit** / **Function** / **Settings** 00 to 03 / Encoder type / 0: Incremental encoder, 1: Absolute encoder 04 to 07 / Reserved by the system. / 0 08 to 11 / Reserved by the system. / 0 12 to 15 / Reserved by the system. / 0
1863 to 1873	1877 to 1887	188B to 189B	189F to 18AF	18B3 to 18C3	18C7 to 18D7	18DB to 18EB	18EF to 18FF	1903 to 1913	1917 to 1927	192B to 193B	193F to 194F	1953 to 1963	1967 to 1977	197B to 198B	198F to 199F	0000 (Reserved by the system.)

Note The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

Servo Parameter Area

The Servo Parameters listed here can be used when the PCU is used with either an R88D-GN□-ML2 G-series Servo Drive, OMRON R88D-WT□ W-series Servo Drive equipped with a Yaskawa JUSP-NS115 MECHATROLINK-II Application Module, an W-series Servo Drive with built-in MECHATROLINK-II communications (R88D-WN□-ML2), or a SMARTSTEP Junior Servo Drive with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2).

For further details on each of the parameters, refer to the operation manuals for OMRON G-series Servo Drives, W-series Servo Drives and Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.

Parameter Tables

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn000	Reserved	---	Do not change.		1	---	---	---	
Pn001	Default Display	2	Selects the data to be displayed on the 7-segment LED display on the front panel.		0	---	0 to 4	Online	
			0	Normal status ("--" Servo OFF, "00" Servo ON)					
			1	Indicates the machine angle from 0 to FF hex. 0 is the zero position of the encoder. The angle increases when the Servomotor turns forward. The count continues from "0" after exceeding "FF". When using an incremental encoder, the display shows "nF" (not Fixed) until detecting the zero position on the encoder after the control power is turned ON.					
			2	Indicates the electrical angle from 0 to FF hex. 0 is the position where the inductive voltage on the U phase reaches the position peak. The angle increases when the Servomotor turns forward. The count continues from "0" after exceeding "FF".					
			3	Indicates the number (total) of MECHATROLINKII communications errors from 0 to FF hex. The communications error count (total) saturates at the maximum of FFFFh. "h" appears only for the lowest byte. The count continues from "00" after exceeding "FF". **Note** The communications error count (total) is cleared by turning OFF the control power.					
			4	Indicates the setting on the rotary switch (node address value) loaded at startup, in decimal. This value does not change even if the rotary switch is turned after startup.					
			5 to 32767	Reserved (Do not set.)					
Pn002	Reserved	---	Do not change.		0	---	---	---	
Pn003	Torque Limit Selection	2	Selects the torque limit function, or the torque feed-forward function during speed control.		1	---	---	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			• Torque Limit Selection For torque control, always select Pn05E. For position control and speed control, select the torque limit as follows.		1	---	1 to 5		
			1	Use Pn05E as the limit value for forward and reverse operations.					
			2	Forward: Use Pn05E. Reverse: Use Pn05F.					
			3	Switch limits by torque limit values and input signals from the network. Limit in forward direction: PCL is OFF = Pn05E, PCL is ON = Pn05F Limit in reverse direction: NCL is OFF = Pn05E, NCL is ON = Pn05F					
			4	Forward: Use Pn05E as limit. Reverse: Use Pn05F as limit. Only in speed control, torque limits can be switched by torque limit values from the network as follows: Limit in forward direction: Use Pn05E command or option command value 1, whichever is smaller. Limit in reverse direction: Use Pn05F command or option command value 2, whichever is smaller.					
			5	Forward: Use Pn05E as limit. Reverse: Use Pn05F as limit. Only in speed control, torque limits can be switched by torque limit values and input signals from the network as follows: Limit in forward direction: PCL is OFF = Pn05E, PCL is ON = Pn05E command or option command value 1, whichever is smaller. Limit in reverse direction: NCL is OFF = Pn05F, NCL is ON = Pn05F command or option command value 2, whichever is smaller.					

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn003</td><td>Torque Limit Selection</td><td>2</td><td colspan="2">Note PCL ON: When either Forward Torque Limit (CN1 PCL: pin 7) or MECHATROLINKII Communications Option Field (P-CL) is ON.
PCL OFF: When both Forward Torque Limit (CN1 PCL: pin 7) and MECHATROLINK-II Communications Option Field (P-CL) are OFF.</td><td>1</td><td>---</td><td>1 to 5</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">• Torque Feed-forward Function Selection</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>1 to 3</td><td>Enabled only during speed control. Disabled if not using speed control.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>4 to 5</td><td>Always disabled</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn004</td><td>Drive Prohibit Input Selection</td><td>2</td><td colspan="2">Sets the function for the Forward and Reverse Drive Prohibit Inputs (CN1 POT: pin 19, NOT: pin 20)</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td></td><td></td><td></td><td>0</td><td>Decelerates and stops according to the sequence set in the Stop Selection for Drive Prohibition Input (Pn066) when both POT and NOT inputs are enabled.
When both POT and NOT inputs are OPEN, the Drive Prohibit Input Error (alarm code 38) will occur.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>1</td><td>Both POT and NOT inputs disabled.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>2</td><td>When either POT or NOT input becomes OPEN, the Drive Prohibit Input Error (alarm code 38) will occur.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn005</td><td>Communications Control</td><td>2</td><td colspan="2">Controls errors and warnings for MECHATROLINK-II communications.
Note Use with thi]s parameter set to 0. Program to stop immediately if using a value other than 0.
Set the Consecutive Communications Error Detection Count in COM_ERR (bit 8 to 11). The communications error (alarm code 83) will occur when a communications error, which is assessed at every MECHATROLINK-II communications cycle, occurs consecutively for the number of the Consecutive Communications Error Detection Count. The error and warning can be masked for debug purposes.
<table><tr><th>bits 15-12</th><th>bits 11-8</th><th>bits 7-4</th><th>bits 3-0</th></tr><tr><td>---</td><td>COM_ERR</td><td>MSK COM WARNG</td><td>MSK COM ALM</td></tr></table>• [bits 8-11] COM_ERR (Consecutive Communications Error Detection Count)
Setting range: 0 to 15.
Consecutive Communications Error Detection Count = COM_ERR + 2
Note These bits are debug functions. Set to enable (0) when not debugging.
• [bits 0-3] MECHATROLINK-II Communications Alarms Mask (MSK COM ALM)
[bit0]0: Communications error (alarm code 83) enabled
1: Communications error (alarm code 83) disabled
[bit1]0: Watchdog data error (alarm code 86) enabled
1: Watchdog data error (alarm code 86) disabled
• [bits 4-7] MECHATROLINK-II Communications Warnings Mask (MSK COM WARNG)
[bit4]0: Data setting warning (warning code 94h) enabled
1: Data setting warning (warning code 94h) disabled
[bit5]0: Command warning (warning code 95h) enabled
1: Command warning (warning code 95h) disabled
[bit6]0: ML-II communications warning (warning code 96h) enabled
1: ML-II communications warning (warning code 96h) disabled</td><td>0</td><td>---</td><td>0 to 3955</td><td>Offline</td><td>Always set to 0.</td></tr>
<tr><td>Pn006</td><td>Power ON Address Display Duration Setting</td><td>2</td><td colspan="2">Sets the duration to display the node address when the control power is turned ON.
Note The node address display has priority even if there are alarms or warnings at power ON.</td><td>30</td><td>ms</td><td>0 to 1000</td><td>Offline</td><td></td></tr>
<tr><td></td><td></td><td></td><td>0 to 6</td><td>600 ms</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>7 to 1000</td><td>set value × 100 ms</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn007	Speed monitor (SP) Selection	2	Selects the output to the Analog Speed Monitor (SP on the front panel). **Note** This monitor output has a delay due to filtering. The Operating Direction Setting (Pn043) does not affect this monitor output. Thus, forward rotation is always positive (+), and reverse rotation is always negative (–).		3	---	0 to 11	Online	
			0	Actual Servomotor speed: 47 r/min/6 V					
			1	Actual Servomotor speed: 188 r/min/6 V					
			2	Actual Servomotor speed: 750 r/min/6 V					
			3	Actual Servomotor speed: 3000 r/min/6 V					
			4	Actual Servomotor speed: 12000 r/min/6 V					
			5	Command speed: 47 r/min/6 V					
			6	Command speed: 188 r/min/6 V					
			7	Command speed: 750 r/min/6 V					
			8	Command speed: 3000 r/min/6 V					
			9	Command speed: 12000 r/min/6 V					
			10	Outputs the Issuance Completion Status (DEN). 0 V: Issuing 5 V: Issuance complete					
			11	Outputs the Gain Selection Status. 0 V: Gain 2 5 V: Gain 1					
Pn008	Torque Monitor (IM) Selection	2	Selects the output to the Analog Torque Monitor (IM on the front panel) **Note** This monitor output has a delay due to filtering. The Operating Direction Setting (Pn043) does not affect this monitor output. Thus, forward rotation is always positive (+), and reverse rotation is always negative (–).		0	---	0 to 14	Online	
			0	Torque command: 100%/3 V					
			1	Position deviation: 31 pulses/3 V					
			2	Position deviation: 125 pulses/3 V					
			3	Position deviation: 500 pulses/3 V					
			4	Position deviation: 2000 pulses/3 V					
			5	Position deviation: 8000 pulses/3 V					
			6 to 10	Reserved					
			11	Torque command: 200%/3 V					
			12	Torque command: 400%/3 V					
			13	Outputs the Issuance Completion Status (DEN). 0 V: Issuing 5 V: Issuance complete					
			14	Outputs the Gain Selection Status. 0 V: Gain 2 5 V: Gain 1					
Pn009	Reserved	---	Do not change.		0	---	---	---	
Pn00A	Prohibit Parameter Changes via Network	2	Allows/prohibits parameter changes via the network.		0	---	0, 1	Online	
			0	Allows parameter changes from the host controller via the network.					
			1	Prohibits parameter changes from the host controller via the network. Attempting to change a parameter via the network when prohibited triggers the Command Warning (warning code 95h).					
Pn00B	Operation Switch When Using Absolute Encoder	2	Selects how the an absolute encoder is used. This parameter is disabled when using an incremental encoder.		0	---	0 to 2	Online	
			0	Use as an absolute encoder.					
			1	Use an absolute encoder as an incremental encoder.					
			2	Use as an absolute encoder but ignore absolute multiturn counter overflow alarm (alarm code 41).					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn00C	RS-232 Baud Rate Setting	2	Sets the baud rate for RS-232 communications.		2	---	0 to 5	Online	
			0	2,400 bps					
			1	4,800 bps					
			2	9,600 bps					
			3	19,200 bps					
			4	38,400 bps					
			5	57,600 bps					
Pn00D	Reserved	---	Do not change.		0	---	---	---	
Pn00E	Reserved	---	Do not change.		0	---	---	---	
Pn00F	Reserved	---	Do not change.		0	---	---	---	
Pn010	Position Loop Gain (RT)	2	Sets the position loop responsiveness. Increasing the gain increases position control responsiveness and shortens stabilization time. Oscillation or overshoot will occur if set too high. Adjust for optimum responsiveness.		400	×0.1 [1/s]	0 to 30000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn011	Speed Loop Gain (RT)	2	Sets the speed loop responsiveness. If the Inertia Ratio (Pn020) is set correctly, this parameter is set to the Servomotor response frequency. Increasing the gain increases the speed control responsiveness, but too much gain may cause oscillating. Small gain may cause overshoot in the speed response. Adjust for optimum responsiveness.		500	×0.1 Hz	1 to 30000	Online	
Pn012	Speed Loop Integration Time Constant (RT)	2	Adjusts the speed loop integration time constant. Set a large value for large load inertia. Decrease the setting for fast response with small inertia. Set 9999 to stop integration operation while retaining the integration value. A setting of 10000 disables integration.		200	×0.1 ms	1 to 10000	Online	
Pn013	Speed Feedback Filter Time Constant (RT)	2	Sets the type of speed detection filter time constant. Normally, use a setting of 0. Increasing the value reduces the noise of the Servomotor but also reduces its responsiveness. This parameter is disabled if the Instantaneous Speed Observer Setting (Pn027) is enabled.		0	---	0 to 5	Online	
Pn014	Torque Command Filter Time Constant (RT)	2	Adjusts the first-order lag filter time constant for the torque command section. The torque filter setting may reduce machine vibration.		80	×0.01 ms	0 to 2500	Online	
Pn015	Speed Feedforward Amount (RT)	2	Sets the speed feed-forward amount. This parameter is particularly useful when fast response is required.		300	×0.1 %	0 to 1000	Online	
Pn016	Feed-forward Filter Time Constant (RT)	2	Sets the time constant for the speed feed-forward first-order lag filter.		100	×0.01 ms	0 to 6400	Online	
Pn017	Reserved	---	Do not change.		0	---	---	---	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th colspan="2">Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn018</td><td>0 to 6400</td><td>2</td><td colspan="3">Sets the position loop gain when using gain 2 switching.
Same function as Pn010.</td><td>200</td><td>×0.1 [1/s]</td><td>0 to 30000</td><td>Online</td><td rowspan="6">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn019</td><td>Speed Loop Gain 2 (RT)</td><td>2</td><td colspan="3">Sets the speed loop gain when using gain 2 switching.
Same function as Pn011.</td><td>800</td><td>×0.1 Hz</td><td>1 to 30000</td><td>Online</td></tr>
<tr><td>Pn01A</td><td>Speed Loop Integration Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the speed loop integration time constant when using gain 2 switching.
Same function as Pn012.
Set 9999 to stop integration operation while retaining the integration value. Setting 10000 disables integration.</td><td>500</td><td>×0.1 ms</td><td>1 to 10000</td><td>Online</td></tr>
<tr><td>Pn01B</td><td>Speed Feedback Filter Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the speed detection filter when using gain 2 switching.
Same function as Pn013. Normally, use a setting of 0.
When Instantaneous Speed Observer Setting (Pn027) is enabled, this parameter will be disabled.</td><td>0</td><td>---</td><td>0 to 5</td><td>Online</td></tr>
<tr><td>Pn01C</td><td>Torque Command Filter Time Constant 2 (RT)</td><td>2</td><td colspan="3">Sets the first-order lag filter time constant for the torque command section when using gain 2 switching.
Same function as Pn014.</td><td>100</td><td>×0.01 ms</td><td>0 to 2500</td><td>Online</td></tr>
<tr><td>Pn01D</td><td>Notch Filter 1 Frequency</td><td>2</td><td colspan="3">Sets the notch frequency of notch filter 1 for resonance suppression.
This filter must be matched with the resonance frequency of the load.
100 to 1499: Filter enabled
1500: Filter disabled</td><td>1500</td><td>Hz</td><td>100 to 1500</td><td>Online</td></tr>
<tr><td>Pn01E</td><td>Notch Filter 1 Width</td><td>2</td><td colspan="3">Selects the notch width of notch filter 1 for resonance suppression.
Normally, use a setting of 2.</td><td>2</td><td>---</td><td>2</td><td>Online</td></tr>
<tr><td>Pn01F</td><td>Reserved</td><td>---</td><td colspan="3">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn020</td><td>Inertia Ratio (RT)</td><td>2</td><td colspan="3">Sets the load inertia as a percentage of the Servomotor rotor inertia.
Setting [%] = (Load inertia / Rotor inertia) × 100
The inertia ratio estimated during realtime autotuning is stored in the EEPROM every 30 minutes.</td><td>300</td><td>%</td><td>0 to 10000</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn021</td><td>Realtime Autotuning Mode Selection</td><td>2</td><td colspan="3">Sets the operating mode for realtime autotuning.
A setting of 3 or 6 will provide faster response to changes in inertia during operation. Operation, however, may be unstable depending on the operating pattern.
Normally, use a setting of 1 or 4.
Set to 4 to 6 when the Servomotor is used as a vertical axis.
Gain switching is enabled at set values 1 to 6.
Use a setting of 7 if operation changes caused by gain switching are a problem.
0: Disabled
1: Horizontal axis mode, Almost no change
2: Horizontal axis mode, Gradual changes
3: Horizontal axis mode, Sudden changes
4: Vertical axis mode, Almost no change
5: Vertical axis mode, Gradual changes
6: Vertical axis mode, Sudden changes
7: Gain switching disable mode, Almost no change</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td></tr>
<tr><td>Pn022</td><td>Realtime Autotuning Machine Rigidity Selection</td><td>2</td><td colspan="3">Sets the machine rigidity for realtime autotuning.
Increasing this value increases the responsiveness.
If the value is changed suddenly by a large amount, the gain will change rapidly, subjecting the machine to shock.
Always start by making small changes in the value, and gradually increase the value while monitoring machine operation.
Cannot be set to 0 when using the Parameter Unit.</td><td>2</td><td>---</td><td>0 to F</td><td>Online</td></tr>
</table>

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn023</td><td>Adaptive Filter Selection</td><td>2</td><td colspan="2">Enables or disables the adaptive filter.
The Adaptive Filter Table Number Display (Pn02F) will be reset to 0 when disabled.
Note When the Vibration Filter Selection (Pn024) is set to a low-pass filter type (Pn024 = 3 to 5), the adaptive filter is forcibly set to disabled (Pn023 = 0).
0 — Adaptive filter disabled.
1 — Adaptive filter enabled. Adaptive operation performed.
2 — Adaptive filter enabled. Adaptive operation will not be performed (i.e., retained).</td><td>0</td><td>---</td><td>0 to 2</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn024</td><td>Vibration Filter Selection</td><td>2</td><td colspan="2">Selects the vibration filter type and switching mode.
• Filter type selection
• Normal type:
Vibration frequency setting range 10.0 to 200.0 Hz
• Low-pass type:
Vibration frequency setting range 1.0 to 200.0 Hz
• Switching mode selection
• No switching: Both 1 and 2 are enabled
• Switching with command direction:
Selects Vibration Frequency 1 in forward direction (Pn02B, Pn02C)
Selects Vibration Frequency 2 in reverse direction (Pn02D, Pn02E)
<table>
<tr><th></th><th>Filter type</th><th>Switching mode</th></tr>
<tr><td>0</td><td>Normal type</td><td>No switching</td></tr>
<tr><td>1</td><td></td><td></td></tr>
<tr><td>2</td><td></td><td>Switching with command direction</td></tr>
<tr><td>3</td><td>Low-pass type</td><td>No switching</td></tr>
<tr><td>4</td><td></td><td></td></tr>
<tr><td>5</td><td></td><td>Switching with command direction</td></tr>
</table></td><td>0</td><td>---</td><td>0 to 5</td><td>Offline</td><td></td></tr>
<tr><td>Pn025</td><td>Normal Mode Autotuning Operation Setting</td><td>2</td><td colspan="2">Sets the operating pattern for normal mode autotuning.
<table>
<tr><th></th><th>Number of rotations</th><th>Rotation direction</th></tr>
<tr><td>0</td><td>Repeat cycles of 2 rotations</td><td>Forward and Reverse (Alternating)</td></tr>
<tr><td>1</td><td></td><td>Reverse and Forward (Alternating)</td></tr>
<tr><td>2</td><td></td><td>Forward only</td></tr>
<tr><td>3</td><td></td><td>Reverse only</td></tr>
<tr><td>4</td><td>Repeat cycles of single rotation</td><td>Forward and Reverse (Alternating)</td></tr>
<tr><td>5</td><td></td><td>Reverse and Forward (Alternating)</td></tr>
<tr><td>6</td><td></td><td>Forward only</td></tr>
<tr><td>7</td><td></td><td>Reverse only</td></tr>
</table></td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn026</td><td>Overrun Limit Setting</td><td>2</td><td colspan="2">Sets the Servomotor's allowable operating range for the position command input range.
Set to 0 to disable the overrun protective function.</td><td>10</td><td>×0.1 rotation</td><td>0 to 1000</td><td>Online</td><td></td></tr>
<tr><td>Pn027</td><td>Instantaneous Speed Observer Setting (RT)</td><td>2</td><td colspan="2">The Instantaneous Speed Observer improves speed detection accuracy, thereby improving responsiveness and reducing vibration when stopping.
When the instantaneous speed observer is enabled, both Speed Feedback Filter Time Constant (Pn013) and Speed Feedback Filter Time Constant 2 (Pn01B) are disabled.
This feature cannot be used with realtime autotuning.
0 — Disabled
1 — Enabled</td><td>0</td><td>---</td><td>0, 1</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn028</td><td>Notch Filter 2 Frequency</td><td>2</td><td colspan="2">Sets the notch frequency of notch filter 2 for resonance suppression.
This parameter must be matched with the resonance frequency of the load.
100 to 1499 — Filter enabled
1500 — Filter disabled</td><td>1500</td><td>Hz</td><td>100 to 1500</td><td>Online</td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn029	Notch Filter 2 Width	2	Selects the notch width of notch filter 2 for resonance suppression. Increasing the value increases the notch width.		2	---	0 to 4	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn02A	Notch Filter 2 Depth	2	Selects the notch depth of notch filter 2 for resonance suppression. Increasing this value decreases the notch depth, thereby reducing the phase lag.		0	---	0 to 99	Online	
Pn02B	Vibration Frequency 1	2	Sets the vibration frequency 1 for damping control to suppress vibration at the end of the load. Measure and set the frequency of the vibration. The frequency setting range depends on the filter type selected in the Vibration Filter Selection (Pn024). • Normal type Setting frequency range: 10.0 to 200.0 Hz (Disabled when set to 0 to 99) • Low-pass type Setting frequency range: 1.0 to 200.0 Hz (Disabled when set to 0 to 9)		0	×0.1 Hz	0 to 2000	Online	
Pn02C	Vibration Filter 1 Setting	2	When setting Vibration Frequency 1 (Pn02B), reduce this setting if torque saturation occurs, or increase it to make the movement faster. Normally, use a setting of 0. The setting range depends on the filter type selected in the Vibration Filter Selection (Pn024), and if Vibration Filter 1 is enabled, the ranges are as follows: **Note** This parameter is disabled when Vibration Filter 1 is disabled. • Normal type Setting range: 100 ≤ Pn02B + Pn02C ≤ Pn02B × 2 or 2000 • Low-pass type Setting range: 10 ≤ Pn02B + Pn02C ≤ Pn02B × 6		0	×0.1 Hz	–200 to 2000	Online	
Pn02D	Vibration Frequency 2	2	Same function as Pn02B.		0	×0.1 Hz	0 to 2000	Online	
Pn02E	Vibration Filter 2 Setting	2	Same function as Pn02C.		0	×0.1 Hz	–200 to 2000	Online	
Pn02F	Adaptive Filter Table Number Display	2	Displays the table entry number corresponding to the frequency of the adaptive filter. This parameter is set automatically when the adaptive filter is enabled (i.e., when the Adaptive Filter Selection (Pn023) is set to a value other than 0), and cannot be changed. When the adaptive filter is enabled, this parameter will be saved in EEPROM approximately every 30 min. If the adaptive filter is enabled the next time the power supply is turned ON, adaptive operation will start with the data saved in EEPROM as the default value. To clear this parameter and reset the adaptive operation, disable the adaptive filter by setting the Adaptive Filter Selection (Pn023) to 0, and then enable it again.		0	---	0 to 64	Online	This is a read-only parameter. You cannot change the setting.
			0 to 4	Filter disabled					
			5 to 48	Filter enabled					
			49 to 64	Enable or disable the filter with Pn022					
Pn030	Gain Switching Operating Mode Selection (RT)	2	Enables or disables gain switching.		1	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Disabled. Uses Gain 1 (Pn010 to Pn014). PI/P operation is switched from MECHATROLINK-II.					
			1	The gain is switched between Gain 1 (Pn010 to Pn014) and Gain 2 (Pn018 to Pn01C).					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn031	Gain Switch Setting (RT)	2	Sets the trigger for gain switching. The details depend on the control mode.		2	---	0 to 10	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Always Gain 1					
			1	Always Gain 2					
			2	Switching from the network					
			3	Amount of change in torque command					
			4	Always Gain 1					
			5	Speed command					
			6	Amount of position deviation					
			7	Position command pulses received					
			8	Positioning Completed Signal (INP) OFF					
			9	Actual Servomotor speed					
			10	Combination of position command pulses received and speed					
Pn032	Gain Switch Time (RT)	2	Enabled when the Gain Switch Setting (Pn031) is set to 3, or 5 to 10. Sets the lag time from the trigger detection to actual gain switching when switching from gain 2 to gain 1.		30	×166 µs	0 to 10000	Online	
Pn033	Gain Switch Level Setting (RT)	2	Sets the judgment level to switch between Gain 1 and Gain 2 when the Gain Switch Setting (Pn031) is set to 3, 5, 6, 9, or 10. The unit for the setting depends on the condition set in the Gain Switch Setting (Pn031).		600	--	0 to 20000	Online	
Pn034	Gain Switch Hysteresis Setting (RT)	2	Sets the hysteresis of the judgment level for the Gain Switch Level Setting (Pn033) when the Gain Switch Setting (Pn031) is set to 3, 5, 6, 9, or 10. The unit for the setting depends on the condition set in the Gain Switch Setting (Pn031).		50	---	0 to 20000	Online	
Pn035	Position Loop Gain Switching Time (RT)	2	This parameter can prevent the position loop gain from increasing suddenly when the position loop gain and position loop gain 2 differ by a large amount. When the position loop gain increases, it takes the duration of (set value + 1) × 166 µs.		20	×166 µs	0 to 10000	Online	
Pn036	Reserved	---	Do not change.		0	---	---	---	
Pn037	Reserved	---	Do not change.		0	---	---	---	
Pn038	Reserved	---	Do not change.		0	---	---	---	
Pn039	Reserved	---	Do not change.		0	---	---	---	
Pn03A	Reserved	---	Do not change.		0	---	---	---	
Pn03B	Reserved	---	Do not change.		0	---	---	---	
Pn03C	Reserved	---	Do not change.		0	---	---	---	
Pn03D	Jog Speed	2	Sets the jog operation speed with the Parameter Unit or CX-Drive. **Note** Jog operation is only available when the network is not established. Do not try to establish the network while using jog operation. Otherwise, command alarm (alarm code 27) will occur.		200	r/min	0 to 500	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn03E	Reserved	---	Do not change.		0	---	---	---	
Pn03F	Reserved	---	Do not change.		0	---	---	---	
Pn040	Reserved	---	Do not change.		0	---	---	---	
Pn041	Emergency Stop Input Setting	2	Enables the Emergency Stop Input (STOP). **Note** If this function is disabled, the response status will always be 0 (disabled).		1	---	0, 1	Offline	
			0	Disabled.					
			1	Enabled (alarm code 87 issued on OPEN)					
Pn042	Origin Proximity Input Logic Setting	2	Sets the logic for the Origin Proximity Input (DEC).		1	---	0, 1	Offline	
			0	N.C contact (origin proximity detected on OPEN)					
			1	N.O contact (origin proximity detected on CLOSE)					
Pn043	Operating Direction Setting	2	Sets the relationship between polarity of operation data sent over the network and the direction of Servomotor rotation. **Note** In RS-232C communications and on the analog monitor (SP, IM) on the front panel, forward direction is always positive (+), and reverse rotation is always negative (–).		1	---	0, 1	Offline	
			0	Disabled.					
			1	Enabled (alarm code 87 issued on OPEN)					

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn044	Input Signal Selection	2	Sets the terminal assignment for Drive Prohibit Input.		1	---	0, 1	Offline	
			0	Sets CN1 pin 19 to POT, CN1 pin 20 to NOT.					
			1	Sets CN1 pin 19 to NOT, CN1 pin 20 to POT.					
Pn045	Reserved	---	Do not change.		0	---	---	---	
Pn046	Reserved	---	Do not change.		0	---	---	---	
Pn047	Reserved	---	Do not change.		0	---	---	---	
Pn048	Reserved	---	Do not change.		0	---	---	---	
Pn049	Reserved	---	Do not change.		0	---	---	---	
Pn04A	Reserved	---	Do not change.		0	---	---	---	
Pn04B	Reserved	---	Do not change.		0	---	---	---	
Pn04C	Reserved	---	Do not change.		0	---	---	---	
Pn04D	Reserved	---	Do not change.		0	---	---	---	
Pn04E	Reserved	---	Do not change.		0	---	---	---	
Pn04F	Reserved	---	Do not change.		0	---	---	---	
Pn050	Reserved	---	Do not change.		0	---	---	---	
Pn051	Reserved	---	Do not change.		0	---	---	---	
Pn052	Reserved	---	Do not change.		0	---	---	---	
Pn053	Speed Limit	2	Sets the speed limit for torque control mode. (The value is an absolute value) This parameter is limited by the Overspeed Detection Level Setting (Pn073).		50	r/min	–20000 to 20000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn054	Reserved	---	Do not change.		0	---	---	---	
Pn055	Reserved	---	Do not change.		0	---	---	---	
Pn056	Reserved	---	Do not change.		0	---	---	---	
Pn057	Reserved	---	Do not change.		0	---	---	---	
Pn058	Soft Start Acceleration Time	2	Sets the acceleration time for speed control mode. Acceleration time [s] from 0 r/min to maximum speed [r/min] = Set value × 2 ms		0	×2 ms	0 to 5000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn059	Soft Start Deceleration Time	2	Sets the deceleration time for speed control mode. Deceleration time [s] from maximum speed [r/min] to 0 r/min = Set value × 2 ms		0	×2 ms	0 to 5000	Online	
Pn05A	Reserved	---	Do not change.		0	---	---	---	
Pn05B		2	Selects the speed limit for torque control mode.		0	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Use the Speed Limit (Pn053)					
			1	Use the speed limit value via MECHATROLINK-II or the Speed Limit (Pn053), whichever is smaller.					
Pn05C	Reserved	---	Do not change.		0	---	---	---	
Pn05D	Reserved	---	Do not change.		0	---	---	---	
Pn05E	No. 1 Torque Limit	2	Sets the No. 1 Torque Limit for the Servomotor output torque. Refer to information on the Torque Limit Selection (Pn003) to select the torque limit. The maximum value of the setting range depends on the applicable Servomotor.		300	%	0 to 500	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn05F	No. 2 Torque Limit	2	Sets the No. 2 torque limit for the Servomotor output torque. Refer to information on the Torque Limit Selection (Pn003) to select the torque limit. The maximum value of the setting range depends on the applicable Servomotor.		100	%	0 to 500	Online	
Pn060	Positioning Completion Range 1	2	Sets the positioning completion range when Positioning Completion 1 (INP1) Output is selected. Positioning is complete when all positioning command pulses are exhausted, and the absolute value of the position deviation converted into command units is less than this setting.		25	Command units	0 to 10000	Online	

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn061	Speed Conformity Signal Output Width	2	Sets the detection width for the speed conformity detection (VCMP) signal. Speed conformity is achieved when the absolute value of the difference between the internal speed command (before acceleration and deceleration limits are applied) and the Servomotor speed is less than the set speed. **Note** This setting has a hysteresis of 10 r/min.		20	r/min	10 to 20000	Online	
Pn062	Rotation Speed for Motor Rotation Detection	2	Sets the threshold level for the speed reached (TGON) signal. Speed reached is determined when the absolute value of the Servomotor speed is greater than the setting speed. **Note** Speed reached detection has a hysteresis of 10 r/min.		50	r/min	10 to 20000	Online	
Pn063	Positioning Completion Range 2	2	Sets the positioning completion range when Positioning Completion 2 (INP2) is selected. Positioning is complete when the absolute value of the position deviation converted into command units is less than this setting, regardless of whether position command pulses are still being processed.		100	Command units	0 to 10000	Online	
Pn064	Motor Phase Current Offset Re-adjustment Setting	2	Enables or disables the offset component readjustment function of the Motor Phase Current Detector (CT) for Servo ON command inputs. The readjustment is made when control power is turned ON. **Note** This adjustment is inaccurate if the offset is measured while the Servomotor is rotating. To enable this function, do not rotate the Servomotor when inputting the Servo ON command.		0	---	0, 1	Online	
			0	Disabled (only when turning ON control power)					
			1	Enabled (when turning ON control power, or at Servo ON)					
Pn065	Undervoltage Alarm Selection	2	Selects whether to activate the main power supply undervoltage function (alarm code 13) when the main power supply is interrupted for the duration of the Momentary Hold Time (Pn06D) during Servo ON.		1	---	0, 1	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
			0	Turns the Servo OFF according to the setting for the Stop Selection with Main Power OFF (Pn067), interrupting the positioning command generation process (positioning operation) within the Servo Drive. When the main power supply is turned back ON, Servo ON will resume. Restart the positioning operation after performing the positioning operation and recovering from Servo OFF.					
			1	Causes an error due to main power supply undervoltage (alarm code 13). This parameter is disabled if Pn06D = 1,000. If Pn06D is set too long and the voltage between P and N in the main power supply converter drops below the specified value before a main power supply interruption is detected, a main power supply undervoltage (alarm code 13) will occur.					

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn066</td><td>Stop Selection for Drive Prohibition Input</td><td>2</td><td colspan="2">Sets the deceleration stop operation to be performed after the Forward Drive Prohibit Input (POT) or Reverse Drive Prohibit Input (NOT) is enabled.

<table>
<tr><th></th><th>During deceleration</th><th>After stopping (30 r/min or less)</th><th>Deviation counter</th></tr>
<tr><td>0</td><td>Dynamic brake</td><td>Disables torque command in drive prohibited direction</td><td>Cleared while decelerating with dynamic brake. Retained after stopping.</td></tr>
<tr><td>1</td><td>Disables torque</td><td>Disables torque command in drive prohibited direction</td><td>Cleared while decelerating. Retained after stopping.</td></tr>
<tr><td>2</td><td>Emergency Stop Torque (Pn06E)</td><td>Servo locked</td><td>Retained while decelerating, cleared upon completion of deceleration, and retained after stopping.</td></tr>
</table>

Note 1. The positioning command generation process (positioning operation) within the Servo Drive will be forcibly stopped once it enters the deceleration mode. Also, when the deceleration mode is activated during speed control or torque control, it will switch to position control. If a positioning operation command is received during deceleration, the internal positioning command generation process will be retained, and after deceleration is complete, positioning operation will be activated.
Note 2. When the Servomotor rotation speed is 30 r/min or less (stopped), the deceleration mode will not be activated even if the drive prohibit input is enabled.
Note 3. When the parameter is set to 2 and an operation command in the drive prohibited direction is received after stopping, a command warning (warning code 95h) will be issued. When the parameter is set to 0 or 1, the operation command in the prohibited direction after stopping will be accepted, but the Servomotor will not operate and the position deviation will accumulate because the torque command is 0. Take measures such as issuing a command in the reverse direction from the host controller.
Note 4. When the parameter is set to 2, MECHATROLINK-II communications are interrupted, and either Forward or Reverse Drive Prohibit Input (POT or NOT) is turned ON, receiving an operation command (jog operation or normal mode autotuning) via RS232 will cause a Drive Prohibit Input Error (alarm code 38). A Drive Prohibit Input Error (alarm code 38) will also occur if either POT or NOT is turned ON while operating on an operation command received via RS232.</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td>P067</td><td>Stop Selection with Main Power OFF</td><td>2</td><td colspan="2">Sets the operation to be performed during deceleration and after stopping after the main power supply is turned OFF with the Undervoltage Alarm Selection (Pn065) set to 0. The deviation counter will be reset when the power OFF is detected.
0 and 4: Use dynamic brake to decelerate and remain stopped with dynamic brake.
1 and 5: Use free-run to decelerate and remain stopped with dynamic brake.
2 and 6: Use dynamic brake to decelerate, but free the motor when stopped.
3 and 7: Use free-run to decelerate, and free the motor when stopped.</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td><td rowspan="3">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn068</td><td>Stop Selection for Alarm Generation</td><td>2</td><td colspan="2">Sets the deceleration process and stop status after an alarm is issued by the protective function. The deviation counter will be reset when an alarm is issued.
0: Use dynamic brake to decelerate and remain stopped with dynamic brake.
1: Use free-run to decelerate and remain stopped with dynamic brake.
2: Use dynamic brake to decelerate, but free the motor when stopped.
3: Use free-run to decelerate, and free the motor when stopped.</td><td>0</td><td>---</td><td>0 to 3</td><td>Online</td></tr>
<tr><td>Pn069</td><td>Stop Selection with Servo OFF</td><td>2</td><td colspan="2">Sets the operational conditions to apply during deceleration and after stopping when the Servo is turned OFF.
The relationship between set values, operation, and deviation counter processing for this parameter is the same as for the Stop Selection with Main Power OFF (Pn067).</td><td>0</td><td>---</td><td>0 to 7</td><td>Online</td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn06A	Brake Timing When Stopped	2	Sets the duration from when the Brake Interlock (BKIR) signal turns OFF to when the Servomotor is de-energized when the RUN command is turned OFF with the Servomotor stopped. **Note** The brake interlock signal is the logical OR of the brake release request from the network and the release request from the Servo controller. Note, the brake release request from the network is OFF (operation request is ON) at power ON.		10	2 ms	0 to 1000	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn06B	Brake Timing during Operation	2	When the run command (RUN) is turned OFF during the Servomotor rotation, the Servomotor will decelerate reducing the rotation speed and the Brake Interlock Signal (BKIR) will turn OFF after the time set by this parameter has elapsed. BKIR turns OFF if the Servomotor speed drops below 30 r/min before the set time. **Note** The brake interlock signal is the logical OR of the brake release request from the network and the release request from the Servo controller. Note, the brake release request from the network is OFF (operation request is ON) at power ON.		50	2 ms	0 to 1000	Online	
Pn06C	Regeneration Resistor Selection	2	Sets the regeneration resistor operation and the regeneration overload (alarm code 18) operation. Set this parameter to 0 if using the built-in regeneration resistor. If using an external regeneration resistor, be sure to turn OFF the main power when the built-in thermal switch is activated.		0	---	0 to 3	Offline	
			0	Sets the regeneration overload to match the built-in regeneration resistor. (regeneration load ratio below 1%)					
			1	The regeneration overload (alarm code 18) occurs when the load ratio of the external regeneration resistor exceeds 10%.					
			2	The regeneration processing circuit by the external regeneration resistor is activated, but the regeneration overload (alarm code 18) does not occur.					
			3	The regeneration processing circuit is not activated. All regenerative energy is absorbed by the built-in capacitor.					
Pn06D	Momentary Hold Time	2	Sets the amount of time required to detect shutoff when the main power supply continues to shut off. The main power OFF detection will be disabled if this parameter is set to 1000.		35	2 ms	35 to 1000	Offline	
Pn06E	Emergency Stop Torque	2	Sets the torque limit during deceleration because of the Drive Prohibition Input when the Stop Selection for Drive Prohibition Input (Pn066) is set to 2. When this parameter is set to 0, the normal torque limit will be set. The maximum value of the setting range depends on the Servomotor.		0	%	0 to 300	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn06F	Reserved	---	Do not change.		0	---	---	---	
Pn070	Reserved	---	Do not change.		0	---	---	---	
Pn071	Reserved	---	Do not change.		0	---	---	---	
Pn072	Overload Detection Level Setting	2	Sets the overload detection level. The overload detection level will be set at 115% if this parameter is set to 0. Normally, use a setting of 0, and set the level only when reducing the overload detection level.		0	%	0 to 500	Online	
Pn073	Overspeed Detection Level Setting	2	Sets the overspeed detection level. The overspeed detection level is 1.2 times the maximum Servomotor rotation speed when the parameter is set to 0. Normally, use a setting of 0, and set the level only when reducing the overspeed detection level. **Note** The detection margin of error for the setting is ±3 r/min for a 7-core absolute encoder and ±36 r/min for a 5-core incremental encoder.		0	r/min	0 to 20000	Online	
Pn074	Reserved	---	Do not change.		0	---	---	---	
Pn075	Reserved	---	Do not change.		0	---	---	---	
Pn076	Reserved	---	Do not change.		0	---	---	---	
Pn077	Reserved	---	Do not change.		0	---	---	---	
Pn078	Reserved	---	Do not change.		0	---	---	---	
Pn079	Reserved	---	Do not change.		0	---	---	---	
Pn07A	Reserved	---	Do not change.		0	---	---	---	
Pn07B	Reserved	---	Do not change.		0	---	---	---	
Pn07C	Reserved	---	Do not change.		0	---	---	---	
Pn07D	Reserved	---	Do not change.		0	---	---	---	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn07E</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn07F</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn100</td><td>Backlash Compensation Selection</td><td>2</td><td colspan="2">Enables or disables the backlash compensation for position control, and sets the compensation direction.
0: Disabled
1: Compensates in the initial positive direction after the Servo ON.
2: Compensates in the initial negative direction after the Servo ON.</td><td>0</td><td>---</td><td>0 to 2</td><td>Offline</td><td></td></tr>
<tr><td>Pn101</td><td>Backlash Compensation</td><td>2</td><td colspan="2">Sets the backlash compensation amount for position control.</td><td>0</td><td>Command units</td><td>–32768 to 32767</td><td>Online</td><td rowspan="2">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn102</td><td>Backlash Compensation Time Constant</td><td>2</td><td colspan="2">Sets the backlash compensation time constant for position control.
<table><tr><th>Value of Pn100</th><th>Pn101 = Positive number</th><th>Pn101 = Negative number</th></tr><tr><td>1</td><td>Compensates in positive direction during rotation in positive direction</td><td>Compensates in negative direction during rotation in positive direction</td></tr><tr><td>2</td><td>Compensates in positive direction during rotation in negative direction</td><td>Compensates in negative direction during rotation in negative direction</td></tr></table></td><td>0</td><td>0.01 ms</td><td>0 to 6400</td><td>Online</td></tr>
<tr><td>Pn103</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn104</td><td>Soft Limit</td><td>2</td><td colspan="2">Enables or disables the soft limit.
When enabled, the soft limit values are set in Forward Software Limit (Pn201) and Reverse Software Limit (Pn202).
Note The response value for limit signals disabled by this setting will be set to 0. The response value for limit signals is also set to 0 when the Servomotor does not complete its return to origin.
0: Enable both the Forward / Reverse Software Limits (Pn201 and Pn202)
1: Disable the Forward Software Limit (Pn201), enable the Reverse Software Limit (Pn202)
2: Enable the Forward Software Limit (Pn201), disable the Reverse Software Limit (Pn202)
3: Disable both the Forward / Reverse Software Limits (Pn201 and Pn202)</td><td>0</td><td>---</td><td>0 to 3</td><td>Online</td><td></td></tr>
<tr><td>Pn105</td><td>Origin Range</td><td>2</td><td colspan="2">Sets the threshold for detecting the origin (ZPOINT) in absolute values.
ZPOINT = 1 when the return to origin completes (coordinate system setup is complete) and the feedback position is within the setting range of this parameter.</td><td>10</td><td>Command units</td><td>0 to 250</td><td>Online</td><td></td></tr>
<tr><td>Pn106</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn107</td><td>Linear Acceleration Constant</td><td>2</td><td colspan="2">Sets the acceleration for positioning operations.
A setting of "0" is regarded as "1".
The setting will be handled after conversion to an unsigned 16-bit data (0 to 65535).
Example: –32768 → 8000h = 32768
–1 → FFFFh = 65535</td><td>100</td><td>× 10000 [command units/s^2]</td><td>–32768 to 32767</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn108</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn109</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10A</td><td>Linear Deceleration Constant</td><td>2</td><td colspan="2">Sets the deceleration for positioning operations.
A setting of "0" is regarded as "1".
The setting will be handled after conversion to an unsigned 16-bit data (0 to 65535).
Example: –32768 → 8000h = 32768
–1 → FFFFh = 65535</td><td>100</td><td>× 10000 [command units/s^2]</td><td>–32768 to 32767</td><td>Online</td><td>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn10B</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10C</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn10D</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
</table>

Parameter No.	Parameter name	Parameter size	Setting	Explanation	Default setting	Unit	Setting range	Enable setting	Details
Pn10E	Moving Average Time	2	Sets the moving average time for position commands. **Note** If the Moving Average Time is set, commands may not be executed seamlessly when switching the control mode, and when switching between interpolation feed motions and positioning motions (motions wherein the command waveforms are generated inside the Servo Drive).		0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn10F	Origin Return Mode Settings	2	Sets the direction for origin return.		0	---	0, 1	Online	
			0	Positive direction					
			1	Negative direction					
Pn110	Origin Return Approach Speed 1	2	Sets the operating speed for origin return from when the origin proximity signal is turned ON, to when it is turned OFF and the latch signal is detected. This parameter can be set to a maximum value of 32767, but internally the speed is limited to the Servomotor's maximum speed.		50	100 [command units/s]	1 to 32767	Online	
Pn111	Origin Return Approach Speed 2	2	Sets the operating speed for origin return, from when the point after the latch signal is detected to when the Origin Return Final Distance (Pn204) is reached. This parameter can be set to a maximum value of 32767, but internally the speed is limited to the Servomotor's maximum speed.		5	100 [command units/s]	1 to 32767	Online	
Pn112	General-purpose Output 1 Function Selection	2	Selects the function for general-purpose output 1 (OUTM1).		7	---	0 to 9	Offline	Standard setting
			0	Always OFF					
			1	INP1 output. Turn ON when position deviation is equal to or less than Pn060 for position control. Undefined when not using position control.					
			2	VCMP output. Turn ON when the deviation between the Servomotor speed and commanded speed is within the range set by Pn061 for speed control. Undefined when not using speed control.					
			3	TGON output. Turn ON when the absolute value of the Servomotor speed exceeds Pn062 setting in all control modes.					
			4	READY output. Turn ON when the main power is supplied, there is no alarm, and Servo SYNC with a host controller is established in all control modes.					
			5	CLIM output. Turn ON when torque limit is activated in all control modes.					
			6	VLIM output. Turn ON when the Servomotor speed reaches the speed limit for torque control. Undefined when not using torque control.					
			7	BKIR output. Turn ON with the release timing of the brake release signal in all control modes.					
			8	WARN output. Turn ON when a warning is issued in all control modes.					
			9	INP2 output. Turn ON when the position deviation is equal to or less than the Positioning Completion Range 2 (Pn063) for position control. Undefined when not using position control.					
Pn113	General-purpose Output 2 Function Selection	2	Selects the function for general-purpose output 2 (OUTM2). The set values and the functions are the same as for general-purpose output 1 (OUTM1).		0	---	0 to 9	Offline	
Pn114	General-purpose Output 3 Function Selection	2	Selects the function for general-purpose output 3 (OUTM3). The set values and the functions are the same as for general-purpose output 1 (OUTM1).		0	---	0 to 9	Offline	
Pn115 to Pn13F	Reserved	---	Do not change.		0	---	---	---	
Pn200	Absolute Origin Offset	4	Sets the offset amount for the encoder position and the mechanical coordinate system position when using an absolute encoder.		0	Command units	–1073741823 to 1073741823	Offline	

<table>
<tr><th>Parameter No.</th><th>Parameter name</th><th>Parameter size</th><th>Setting</th><th>Explanation</th><th>Default setting</th><th>Unit</th><th>Setting range</th><th>Enable setting</th><th>Details</th></tr>
<tr><td>Pn201</td><td>Forward Software Limit</td><td>4</td><td colspan="2">Sets the soft limit in the forward direction.
If the Servomotor exceeds the limit, the network response status (PSOT) will turn ON (=1).
Note Be sure to set the limits so that Forward Software Limit > Reverse Software Limit.
Note PSOT is not turned ON when origin return is incomplete.</td><td>500000</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td></td></tr>
<tr><td>Pn202</td><td>Reverse Software Limit</td><td>4</td><td colspan="2">Sets the soft limit for the reverse direction.
If the Servomotor exceeds the limit, the network response status (NSOT) will turn ON (=1).
Note Be sure to set the limits so that Forward Software Limit > Reverse Software Limit.
Note NSOT is not turned ON when origin return is incomplete.</td><td>–500000</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td></td></tr>
<tr><td>Pn203</td><td>Final Distance for External Input Positioning</td><td>4</td><td colspan="2">Sets the distance to travel after detecting the latch signal input position when performing external input positioning.
The operation after detecting the latch signal input position will be determined by the external input positioning direction and this parameter as follows.
<table><tr><th rowspan="2">External input positioning direction</th><th colspan="2">Sign</th></tr><tr><th>Positive</th><th>Negative</th></tr><tr><td>Positive direction</td><td>Moves in the positive direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the negative direction and stops</td></tr><tr><td>Negative direction</td><td>Decelerates to a stop, reverses, then moves in the positive direction and stops</td><td>Moves in the negative direction and stops*1</td></tr></table>*1. Reverses after decelerating to a stop if the final distance for external input positioning is short in comparison to the deceleration distance.</td><td>100</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td><td rowspan="3">Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).</td></tr>
<tr><td>Pn204</td><td>Origin Return Final Distance</td><td>4</td><td colspan="2">Sets the distance from the latch signal input position to the origin when performing origin return.
The operation after detecting the latch signal input position will be determined by the origin return direction and this parameter as follows.
<table><tr><th rowspan="2">Origin return direction</th><th colspan="2">Sign</th></tr><tr><th>Positive</th><th>Negative</th></tr><tr><td>Positive direction</td><td>Moves in the positive direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the negative direction and stops</td></tr><tr><td>Negative direction</td><td>Moves in the negative direction and stops*1</td><td>Decelerates to a stop, reverses, then moves in the positive direction and stops</td></tr></table>*1. Reverses after decelerating to a stop if the final travel distance for origin return is short in comparison to the deceleration distance.</td><td>100</td><td>Command units</td><td>–1073741823 to 1073741823</td><td>Online</td></tr>
<tr><td>Pn205</td><td>Electronic Gear Ratio 1 (Numerator)</td><td>4</td><td colspan="2">Sets the numerator for the electronic gear ratio.
Setting this parameter to 0 automatically sets the encoder resolution as the numerator. (131072 for a 17-bit absolute encoder, or 10000 for a 2,500-p/r incremental encoder).
Note Set the electronic gear ratio within the range of 1/100 to 100 times. A parameter setting alarm (alarm code 93) will occur if the ratio is set outside of this range.</td><td>1</td><td>---</td><td>0 to 131072</td><td>Offline</td><td></td></tr>
<tr><td>Pn206</td><td>Electronic Gear Ratio 2 (Denominator)</td><td>4</td><td colspan="2">Sets the denominator for the electronic gear ratio.
Note Set the electronic gear ratio within the range of 1/100 to 100 times. A parameter setting alarm (Alarm code 93) will occur if the ratio is set outside of this range.</td><td>1</td><td>---</td><td>1 to 65535</td><td>Offline</td><td></td></tr>
<tr><td>Pn207</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn208</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Pn209</td><td>Deviation Counter Overflow Level</td><td>4</td><td colspan="2">Sets the deviation counter overflow level.
The value will become saturated at 134217728 (= 2^{27}) pulses after multiplying with the electronic gear ratio.
Setting this parameter to 0 will disable deviation counter overflow.</td><td>20000</td><td>Command units</td><td>0 to 2147483647</td><td>Online</td><td></td></tr>
<tr><td>Pn20A to Pn21F</td><td>Reserved</td><td>---</td><td colspan="2">Do not change.</td><td>0</td><td>---</td><td>---</td><td>---</td><td></td></tr>
</table>

R88D-WT□ W-series Servo Drive Equipped with JUSP-NS115

Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switch	2	0	Reverse rotation	0	CCW direction is taken for positive command.	0	---	---	Offline	---
					1	CW direction is taken for positive command.					
			1	Not used.	---	The setting is disabled. (Do not change the setting.)	1	---	---	---	---
			2	Unit No. setting	0 to F	Servo Drive communications unit number setting when using personal computer monitoring software	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn001	Function selection application switch 1	2	0	Select stop if an alarm occurs when Servomotor is OFF	0	Servomotor stopped by dynamic brake.	2	---	---	Offline	---
					1	Servomotor stopped by dynamic brake. Dynamic brake released after stopping.					
					2	Servomotor stopped with free run.					
			1	Select stop when prohibited drive is input	0	Stop according to Pn001.0 settings (release Servomotor after stopping).	0	---	---	Offline	---
					1	Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping.					
					2	Stop Servomotor using torque set in Pn406, and release Servomotor after stopping.					
			2	Select AC/DC power input	0	AC power supply: AC power supplied from L1, L2, (L3) terminals	0	---	---	Offline	---
					1	DC power supply: DC power supplied from +1, – terminals					
			3	Select warning code output	0	Alarm code only output from ALO1, ALO2, ALO3	1	---	---	Offline	---
					1	Alarm code and warning code both output from ALO1, ALO2, ALO3					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn002	Function selection application switch 2	2	0	Torque command input change (during speed control)	0	Option command value not used.	0	---	---	Offline	---
					1	Option command value 1 used as torque limit input.					
					2	Option command value 1 used as the torque feed forward input.					
					3	Option command values 1 and 2 used as torque limit inputs according to the forward/reverse rotation current limit setting.					
			1	Speed command input change (during torque control)	0	Option command value not used.	0	---	---	Offline	---
					1	Option command value 1 used as speed limit input.					
			2	Operation switch when using absolute encoder	0	Use as absolute encoder.	0	---	---	Offline	---
					1	Use as incremental encoder.					
			3	Fully-closed encoder usage method	0	Fully-closed encoder is not used.	0	---	---	Offline	---
					1	Fully-closed encoder is used without phase Z.					
					2	Fully-closed encoder is used with phase Z.					
					3	Fully-closed encoder is used in Reverse Rotation Mode without phase Z.					
					4	Fully-closed encoder is used in Reverse Rotation Mode with phase Z.					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn003	Function selection application switch 3	2	0	Analog monitor 1 (AM) allocation	0	Servomotor rotation speed: 1 V/1,000 r/min	2	---	---	Online	---
					1	Speed command: 1 V/1,000 r/min					
					2	Torque command: 1 V/100%					
					3	Position deviation: 0.05 V/1 command unit					
					4	Position deviation: 0.05 V/100 command units					
					5	Command pulse frequency: 1 V/1,000 r/min					
					6	Servomotor rotation speed: 1 V/250 r/min					
					7	Servomotor rotation speed: 1 V/125 r/min					
					8 to F	Not used.					
			1	Analog monitor 2 (NM) allocation	0 to F	Same as Pn003.0	0	---	---	Online	---
			2 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn004	Not used.	---	---	---	---	(Do not change the setting.)	0200	---	---	---	Fixed setting: 0200
Pn005	Not used.	---	---	---	---	(Do not change the setting.)	0000	---	---	---	---

Servo Gain Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn100	Speed loop gain	2	Adjusts speed loop responsiveness.				80	Hz	1 to 2000	Online	---
Pn101	Speed loop integration constant	2	Speed loop integral time constant				2000	×0.01 ms	15 to 51200	Online	---
Pn102	Position loop gain	2	Adjusts position loop responsiveness.				40	1/s	1 to 2000	Online	---
Pn103	Inertia ratio	2	Sets using the ratio between the machine system inertia and the Servomotor rotor inertia.				300	%	0 to 20000	Online	---
Pn104	Speed loop gain 2	2	Adjusts speed loop responsiveness (enabled by automatic gain switching input).				80	Hz	1 to 2000	Online	---
Pn105	Speed loop integration constant 2	2	Speed loop integral time constant (enabled by automatic gain switching input)				2000	×0.01 ms	15 to 51200	Online	---
Pn106	Position loop gain 2	2	Adjusts position loop responsiveness (enabled by automatic gain switching input).				40	1/s	1 to 2000	Online	---
Pn107	Bias rotational speed	2	Sets position control bias.				0	r/min	0 to 450	Online	---
Pn108	Bias addition band	2	Sets the position control bias operation start using deviation counter pulse width.				7	Command unit	0 to 250	Online	---
Pn109	Feed-forward amount	2	Position control feed-forward compensation value				0	%	0 to 100	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn10A	Feed-forward command filter	2	Sets position control feed-forward command filter.				0	×0.01 ms	0 to 6400	Online	---
Pn10B	Speed control setting	2	0	P control switching conditions	0	Sets internal torque command value conditions (Pn10C).	4	---	---	Online	---
					1	Sets speed command value conditions (Pn10D).					
					2	Sets acceleration command value conditions (Pn10E).					
					3	Sets deviation pulse value conditions (Pn10F).					
					4	No P control switching function					
			1	Speed control loop switching	0	PI control	0	---	---	Offline	---
					1	IP control					
			2	Automatic gain switching	0	Automatic gain switching disabled	0	---	---	Offline	---
					1	Gain switching using position commands					
					2	Gain switching using position deviation					
					3	Gain switching using position commands and position deviation					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn10C	P control switching (torque command)	2	Sets level of torque command to switch from PI control to P control.				200	%	0 to 800	Online	---
Pn10D	P control switching (speed command)	2	Sets level of speed command to switch from PI control to P control.				0	r/min	0 to 10000	Online	---
Pn10E	P control switching (acceleration command)	2	Sets level of acceleration command to switch from PI control to P control.				0	10 r/min/s	0 to 3000	Online	---
Pn10F	P control switching (deviation pulse)	2	Sets level of deviation pulses to switch from PI control to P control.				10	Command unit	0 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn110	Online autotuning setting	2	0	Select online autotuning	0	Autotunes initial operations only after power is turned ON.	2	---	---	Offline	---
					1	Always autotunes.					
					2	No autotuning					
			1	Select speed feedback compensation function	0	ON	1	---	---	Online	---
					1	OFF					
			2	Select adhesive friction compensation function	0	Friction compensation: OFF	0	---	---	Online	---
					1	Friction compensation: Rated torque ratio small					
					2	Friction compensation: Rated torque ratio large					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn111	Speed feedback compensation gain	2	Adjusts speed loop feedback gain.				100	%	1 to 500	Online	---
Pn112 to Pn123	Not used.	---	(Do not change the setting.)				---	---	---	---	---
Pn124	Automatic gain switching timer	2	Sets the switching delay after conditions have been met, when the automatic gain switching function is used. (Pn10B.2 = 1 to 3).				100	ms	1 to 10000	Online	---
Pn125	Automatic gain switching width (amount of position deviation)	2	Sets the position deviation used as the switching condition when the automatic gain switching function by position deviation (Pn10B.2 = 2, 3) is used.				7	Command unit	1 to 250	Online	---

Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn200	Position control setting 1	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn201	Encoder divider rate	2	Sets the number of output pulses from the Servo Drive.				1000	Pulses /rotation	16 to 16384	Offline	---
Pn202	Electronic gear ratio G1 (numerator)	2	Sets the pulse rate for the command pulses and Servomotor travel distance. $0.01 \leq G1/G2 \leq 100$				4	---	1 to 65535	Offline	---
Pn203	Electronic gear ratio G2 (denominator)	2					1	---	1 to 65535	Offline	---
Pn204	Not used.	---	(Do not change the setting.)				0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn205	Absolute encoder multi-turn limit setting	2	Sets the limit to the rotation speed when using a Servomotor with an absolute encoder.				65535	Rotations	0 to 65535	Offline	---
Pn206	Number of fully-closed encoder pulses	2	Sets the number of fully-closed encoder pulses for each motor rotation.				16384	Pulses /rotation	513 to 32768	Offline	---
Pn207	Position control setting 2	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn208	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn212	Not used.	---	(Do not change the setting.)				2048	---	---	---	---
Pn217	Not used.	---	(Do not change the setting.)				1	---	---	---	---
Pn218	Position control setting 3	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Speed Control Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn300	Not used.	---	(Do not change the setting.)	1000	---	---	---	---
Pn301	Not used.	---	(Do not change the setting.)	100	---	---	---	---
Pn302	Not used.	---	(Do not change the setting.)	200	---	---	---	---
Pn303	Not used.	---	(Do not change the setting.)	300	---	---	---	---
Pn304	Jog speed	2	Sets the rotation speed used during jog operation (executed from the Servo Drive's Parameter Unit).	500	r/min	0 to 10000	Online	---
Pn305	Soft start acceleration time	2	Sets acceleration time during speed control soft start.	0	ms	0 to 10000	Online	---
Pn306	Soft start deceleration time	2	Sets deceleration time during speed control soft start.	0	ms	0 to 10000	Online	---
Pn307	Not used.	---	(Do not change the setting.)	40	---	---	---	---
Pn308	Speed feedback filter time constant	2	Sets filter time constant for speed feedback.	0	×0.01 ms	0 to 65535	Online	---
Pn309	Not used.	---	(Do not change the setting.)	60	---	---	---	---

Torque Control (Torque Limit) Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn400	Not used.	---	(Do not change the setting.)				30	---	---	---	---
Pn401	Torque command filter time constant	2	Sets the filter time constant for the internal torque command.				40	×0.01 ms	0 to 65535	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn402	Forward torque limit	2	Forward rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn403	Reverse torque limit	2	Reverse rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn404	Forward rotation external current limit	2	Output torque limit during input of forward rotation current limit (rated torque ratio).				100	%	0 to 800	Online	---
Pn405	Reverse rotation external current limit	2	Output torque limit during input of reverse rotation current limit (rated torque ratio).				100	%	0 to 800	Online	---
Pn406	Emergency stop torque	2	Deceleration torque when an error occurs (rated torque ratio).				350	%	0 to 800	Online	---
Pn407	Speed limit	2	Sets the speed limit in torque control mode.				3000	r/min	0 to 10000	Online	---
Pn408	Torque command setting	2	0	Selects notch filter 1 function	0	Notch filter 1 not used.	0	---	---	Online	---
					1	Notch filter 1 used for torque commands.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Selects notch filter 2 function	0	Notch filter 2 not used.	0	---	---	Online	---
					1	Notch filter 2 used for torque commands.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn409	Notch filter 1 frequency	2	Sets notch filter 1 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40A	Notch filter 1 Q value	2	Sets Q value of notch filter 1.				70	×0.01	50 to 400	Online	---
Pn40B	Notch filter 2 frequency	2	Sets notch filter 2 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40C	Notch filter 2 Q value	2	Sets Q value of notch filter 2.				70	×0.01	50 to 400	Online	---

I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn500	Positioning completion range 1	2	Sets the width of the positioning completed range.				3	Command unit	0 to 250	Online	---
Pn501	Not used.	---	(Do not change the setting.)				10	---	---	---	---
Pn502	Rotation speed for motor rotation detection	2	Sets the number of rotations for detecting the Zero Speed Flag.				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag.				10	r/min	0 to 100	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn504	Positioning completion range 2	2	Sets the proximity range for the Positioning Proximity Flag.				3	Command unit	1 to 250	Online	---
Pn505	Deviation counter overflow level	2	Sets the detection level for the deviation counter over alarm.				1024	×256 pulses	1 to 32767	Online	---
Pn506	Brake timing 1	2	Sets the delay from the brake command to the Servomotor turning OFF.				0	×10 ms	0 to 50	Online	---
Pn507	Brake command speed	2	Sets the rotation speed for outputting the brake command.				100	r/min	0 to 10000	Online	---
Pn508	Brake timing 2	2	Sets the delay from the Servomotor turning OFF to the brake command output.				50	×10 ms	10 to 100	Online	---
Pn509	Momentary hold time	2	Sets the time during which alarm detection is disabled when a power failure occurs.				20	ms	20 to 1000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selection 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	Fixed setting: 1
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	POT (forward drive prohibited input) signal input terminal allocation	0	Allocated to CN1, pin 40: Valid for low input	8	---	---	Offline	Standard setting: 2
					1	Allocated to CN1, pin 41: Valid for low input					
					2	Allocated to CN1, pin 42: Valid for low input					
					3	Allocated to CN1, pin 43: Valid for low input					
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always valid.					
					8	Always invalid.					
					9	Allocated to CN1, pin 40: Valid for high input					
					A	Allocated to CN1, pin 41: Valid for high input					
					B	Allocated to CN1, pin 42: Valid for high input					
					C	Allocated to CN1, pin 43: Valid for high input					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50B	Input signal selection 2	2	0	NOT (reverse drive prohibited input) signal input terminal allocation	0 to F	Same as Pn50A.3	8	---	---	Offline	Standard setting: 3
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	PCL (forward rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	5	---	---	Offline	Standard setting: 8
			3	NCL (reverse rotation current limit) signal input terminal allocation	0 to F	Same as Pn50A.3	6	---	---	Offline	Standard setting: 8
Pn50C	Input signal selection 3	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
Pn50D	Input signal selection 4	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	Fixed setting: 8
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50E	Output signal selection 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	No output	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pins 25, 26					
					2	Allocated to CN1, pins 27, 28					
					3	Allocated to CN1, pins 29, 30					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0	1	---	---	Offline	Standard setting: 0
			2	TGON (Servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	2	---	---	Offline	Standard setting: 0
			3	READY (Servomotor warmup complete) signal output terminal allocation	0 to 3	Same as Pn50E.0	3	---	---	Offline	Standard setting: 3

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50F	Output signal selection 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 2
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
Pn510	Output signal selection 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selection 5	2	0	DEC signal input terminal allocation	0	Allocated to CN1, pin 40: Valid for low input	8	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pin 41: Valid for low input					
					2	Allocated to CN1, pin 42: Valid for low input					
					3	Allocated to CN1, pin 43: Valid for low input					
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 40: Valid for high input					
					A	Allocated to CN1, pin 41: Valid for high input					
					B	Allocated to CN1, pin 42: Valid for high input					
					C	Allocated to CN1, pin 43: Valid for high input					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selection 5	2	1	EXT1 signal input terminal allocation	0 to 3	Always disabled.	8	---	---	Offline	Standard setting: 4
					4	Allocated to CN1, pin 44: Valid for low input					
					5	Allocated to CN1, pin 45: Valid for low input					
					6	Allocated to CN1, pin 46: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9 to C	Always disabled.					
					D	Allocated to CN1, pin 44: Valid for high input					
					E	Allocated to CN1, pin 45: Valid for high input					
					F	Allocated to CN1, pin 46: Valid for high input					
			2	EXT2 signal input terminal allocation	0 to F	Same as Pn511.1	8	---	---	Offline	Standard setting: 5
			3	EXT3 signal input terminal allocation	0 to F	Same as Pn511.1	8	---	---	Offline	Standard setting: 6
Pn512	Output signal reverse	2	0	Output signal reverse for CN1 pins 25, 26	0	Not reversed.	0	---	---	Offline	---
					1	Reversed.					
			1	Output signal reverse for CN1 pins 27, 28	0, 1	Same as above	0	---	---	Offline	---
			2	Output signal reverse for CN1 pins 29, 30	0, 1	Same as above	0	---	---	Offline	---
			3	Not used.	---	(Do not change the setting.)	0	---	---	---	---
Pn513	Input signal selection 6	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn51A	Motor-load deviation over level	2	Sets the allowable range for the number of pulses for fully-closed encoders and semi-closed encoders.				0	Pulse	0 to 32767	Online	---
Pn51B	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn51C	Not used.	---	(Do not change the setting.)				450	---	---	---	---
Pn51E	Deviation counter overflow warning level	2	Sets the detection level for the deviation counter overflow warning.				0	%	0 to 100	Online	---

Other Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn600	Regeneration resistor capacity	2	Setting for the regeneration resistance load ratio monitoring calculations.	0	×10 W	From 0 (Varies by Unit.)	Online	---
Pn601	Not used.	0	(Do not change the setting.)	---	---	---	---	---

Control Function Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	MECHATROLINK-II communications check mask	0	Detects both communications errors (A.E6) and synchronization errors (A.E5).	0	---	---	Online	Always set to 0.
					1	Ignores communications errors (A.E6).					
					2	Ignores synchronization errors (A.E5).					
					3	Ignores both communications errors (A.E6) and synchronization errors (A.E5).					
			1	Warning check mask	0	Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameters setting warnings (A.94).					
					2	Ignores MECHATROLINK-II command warnings (A.95).					
					3	Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95).					
					4	Ignores communications errors (A.96).					
					5	Ignores both parameter setting warnings (A.94) and communications errors (A.96).					
					6	Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96).					
					7	Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96).					
			2	Communications error count at single transmission	0 to F	Detects a communications error (A.E6) when the number of errors specified by the set value + 2 have occurred continuously.	0	---	---	Online	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Software limits	2	0	Software limit function	0	Software limit enabled.	0	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Software limit disabled in both directions.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using references	0	No software limit check using references.	0	---	---	Online	Always set to 0.
					1	Software limit check using references.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn802	Not used.	---	(Do not change the setting.)	0000	---	---	---	---
Pn803	Zero point width	2	Sets the detection range for the Origin Stop Flag.	10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the forward software limit.	819,191,808	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the reverse software limit.	–819,191,808	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn808	Absolute encoder zero point position offset	4	Sets the offset for the mechanical origin from the absolute encoder's absolute value data.	0	Command unit	–1,073,741,823 to 1,073,741,823	Offline	---
Pn80A	First-step linear acceleration constant	2	Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80B	Second-step linear acceleration constant	2	Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80C	Acceleration constant switching speed	2	Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn80D	First-step linear deceleration constant	2	Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Second-step linear deceleration constant	2	Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80F	Deceleration constant switching speed	2	Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn810	Exponential acceleration/ deceleration bias	2	Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control.	0	Command units/s	0 to 32767	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn811	Exponential acceleration/ deceleration time constant	2	Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn812	Movement average time	2	Sets the S-curve acceleration/deceleration moving average time for the acceleration/deceleration curve used in position control.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn813	Not used.	---	(Do not change the setting.)	0010	---	---	---	---
Pn814	Final travel distance for external positioning	4	Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation.	100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode setting	2	0	Zero point return direction	0	Forward	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search.				100	Command unit	–1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn81B	Backlash compensation amount	2	Sets the amount of backlash compensation.				0	×0.1 command unit	–32,768 to 32,767	Online	---
Pn81C	Not used.	---	(Do not change the setting.)				0000	---	---	---	---
Pn81D	Compensation function selection	2	0	Backlash compensation selection	0	Compensates in forward direction.	0	---	---	Offline	---
					1	Compensates in reverse direction.					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn81E to Pn823	Not used.	---	(Do not change the setting.)				0000	---	---	---	---

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Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switches	2	0	Reverse rotation	0	CCW direction is taken for positive command	0	---	---	Offline	---
					1	CW direction is taken for positive command					
					2 to 3	Not used.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Unit No. setting	0 to F	Servo Drive communications unit number setting (necessary for multiple Servo Drive connections when using personal computer monitoring software)	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn001	Function selection application switches 1	2	0	Stop selection if an alarm occurs when Servomotor is OFF	0	Servomotor stopped by dynamic brake.	2	---	---	Offline	---
					1	Dynamic brake OFF after Servomotor stopped					
					2	Servomotor stopped with free run					
			1	Stop selection when drive prohibited is input	0	Stop according to Pn001.0 setting (release Servomotor after stopping)	0	---	---	Offline	---
					1	Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping					
					2	Stop Servomotor using torque set in Pn406, and release Servomotor after stopping					
			2	AC/DC power input selection	0	AC power supply: AC power supplied from L1, L2, (L3) terminals	0	---	---	Offline	---
					1	DC power supply: DC power from +, – (2) terminals					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn002	Function selection application switches 2	2	0	Torque command input change (during speed control)	0	Do not use option command value.	0	---	---	Offline	---
					1	Use option command value 1 as the torque limit value.					
					2	Use option command value 1 as the torque feed forward command value.					
					3	Use option command value 1 or 2 as the torque limit value, according to the forward and reverse torque limits that are specified.					
			1	Speed command input change (during torque control)	0	Do not use option command value.	0	---	---	Offline	---
					1	Use option command value 1 as the speed limit value.					
			2	Operation switch when using absolute encoder	0	Use as absolute encoder	0	---	---	Offline	---
					1	Use as incremental encoder					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn004	Function selection application switches 4	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn006	Function selection application switches 6	2	0 to 1	Analog monitor 1 (AM) signal selection	00	Servomotor rotation speed: 1 V/1000 r/min	02	---	---	Online	---
					01	Speed command: 1 V/1000 r/min					
					02	Torque command: gravity compensation torque (Pn422) (1 V per 100%)					
					03	Position deviation: 0.05 V/1 command unit					
					04	Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit)					
					05	Position command speed (1 V/1,000 r/min)					
					06	Not used.					
					07	Not used.					
					08	Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V					
					09	Speed feed forward (1 V/1,000 r/min)					
					0A	Torque feed forward (1 V per 100%)					
					0B to 1F	Not used.					
			2	Analog monitor 1 signal multiplier selection	0	1x	0	---	---	Online	---
					1	10x					
					2	100x					
					3	1/10x					
					4	1/100x					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn007	Function selection application switches 7	2	0 to 1	Analog monitor 2 (NM) signal selection	00	Servomotor rotation speed: 1V/1000 r/min	00	---	---	Online	---
					01	Speed command: 1 V/1000 r/min					
					02	Torque command: gravity compensation torque (Pn422) (1 V per 100%)					
					03	Position deviation: 0.05 V/1 command unit					
					04	Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit)					
					05	Position command speed (1 V/1,000 r/min)					
					06	Not used.					
					07	Not used.					
					08	Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V					
					09	Speed feed forward (1 V/1,000 r/min)					
					0A	Torque feed forward (1 V per 100%)					
					0B to 1F	Not used.					
			2	Analog monitor 2 signal multiplier selection	0	1x	0	---	---	Online	---
					1	10x					
					2	100x					
					3	1/10x					
					4	1/100x					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn008	Function selection application switches 8	2	0	Lowered battery voltage alarm/warning selection	0	Regard battery voltage drop as alarm (A.830).	0	---	---	Offline	---
					1	Regard battery voltage drop as warning (A.930).					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Warning detection selection	0	Warnings detected.	0	---	---	Offline	---
					1	Warnings not detected.					
			3	Not used.	4	(Do not change the setting.)	4	---	---	---	---

Servo Gain Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn100	Speed loop gain	2	Adjusts speed loop response.				800	×0.1 Hz	10 to 20000	Online	---
Pn101	Speed loop integration constant	2	Speed loop integral time constant				2000	×0.01 ms	15 to 51200	Online	---
Pn102	Position loop gain	2	Adjusts position loop response.				400	×0.1/s	10 to 20000	Online	---
Pn103	Inertia ratio	2	Set using the ratio between the machine system inertia and the Servomotor rotor inertia.				300	%	0 to 20000	Online	---
Pn104	Speed loop gain 2	2	Adjusts speed loop response (enabled by automatic gain switching input).				800	×0.1 Hz	10 to 20000	Online	---
Pn105	Speed loop integration constant 2	2	Speed loop integral time constant (enabled by automatic gain switching input).				2000	×0.01 ms	15 to 51200	Online	---
Pn106	Position loop gain 2	2	Adjusts position loop response (enabled by automatic gain switching input).				400	×0.1/s	10 to 20000	Online	---
Pn107	Bias rotational speed	2	Sets position control bias.				0	r/min	0 to 450	Online	---
Pn108	Bias addition band	2	Sets the position control bias operation start using deviation counter pulse width.				7	Command unit	0 to 250	Online	---
Pn109	Feed-forward amount	2	Position control feed-forward compensation value				0	%	0 to 100	Online	---
Pn10A	Feed-forward command filter	2	Sets position control feed-forward command filter.				0	×0.01 ms	0 to 6400	Online	---
Pn10B	Speed control setting	2	0	P control switching conditions	0	Sets internal torque command value conditions (Pn10C).	4	---	---	Online	---
					1	Sets speed command value conditions (Pn10d).					
					2	Sets acceleration command value conditions (Pn10E).					
					3	Sets deviation pulse value conditions (Pn10F).					
					4	No P control switching function					
			1	Speed control loop switching	0	PI control	0	---	---	Offline	---
					1	IP control					
					2 to 3	Not used.					
			2	Position loop control method	0	Standard position control	0	---	---	Offline	---
					1	Less deviation control					
					2 to 3	Not used.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn10C	P control switching (torque command)	2	Sets level of torque command to switch from PI control to P control.				200	%	0 to 800	Online	---
Pn10D	P control switching (speed command)	2	Sets level of speed command to switch from PI control to P control.				0	r/min	0 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn10E	P control switching (acceleration command)	2	Sets level of acceleration command to switch from PI control to P control.				0	r/min/s	0 to 30000	Online	---
Pn10F	P control switching (deviation pulse)	2	Sets level of deviation pulses to switch from PI control to P control.				10	Command unit	0 to 10000	Online	---
Pn110	Normal autotuning switches	2	0	Not used.	2	(Do not change the setting.)	2	---	---	Offline	---
			1	Speed feedback compensation function selection	0	ON	1	---	---	Offline	---
					1	OFF					
					2 to 3	Not used.					
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn111	Speed feedback compensating gain	2	Adjusts speed loop feedback gain.				100	%	1 to 500	Online	---
Pn119	Not used.	---	(Do not change the setting.)				500	---	---	---	---
Pn11A	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn11E	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn11F	Position integral time constant	2	Position loop integral time constant				0	×0.1 ms	0 to 50000	Online	---
Pn12B	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12C	Not used.	---	(Do not change the setting.)				2000	---	---	---	---
Pn12D	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12E	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn12F	Not used.	---	(Do not change the setting.)				2000	---	---	---	---
Pn130	Not used.	---	(Do not change the setting.)				400	---	---	---	---
Pn131	Gain switching time 1	2	Switching time from No. 1 gain to No. 2 gain				0	ms	0 to 65535	Online	---
Pn132	Gain switching time 2	2	Switching time from No. 2 gain to No. 1 gain				0	ms	0 to 65535	Online	---
Pn135	Gain switching waiting time 1	2	The time from when gain switching condition A is satisfied until switching from the No. 1 gain to the No. 2 gain begins.				0	ms	0 to 65535	Online	---
Pn136	Gain switching waiting time 2	2	The time from when gain switching condition B is satisfied until switching from the No. 2 gain to the No. 1 gain begins.				0	ms	0 to 65535	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn139	Automatic gain changeover related switches 1	2	0	Gain switching selection switch	0	Manual gain switching (automatic gain switching not used)	0	---	---	Offline	---
					1	Automatic switching pattern 1 Automatic switching from No. 1 gain to No. 2 gain when gain switching condition A is satisfied. Automatic switching from No. 2 gain to No. 1 gain when gain switching condition B is satisfied.					
					2 to 4	Not used.					
			1	Gain switching condition A	0	Positioning completed output 1 (INP1) ON	0	---	---	Offline	---
					1	Positioning completed output 1 (INP1) OFF					
					2	Positioning completed output 2 (INP2) ON					
					3	Positioning completed output 2 (INP2) OFF					
					4	The position command filter output is 0, and also the position command input is 0.					
					5	The position command input is not 0.					
			2	Gain switching condition B	0 to 5	Same as Pn139.1	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn144	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn150	Predictive control selection switches	2	0	Predictive control selection	0	Predictive control not used.	0	---	---	Offline	---
					1	Predictive control used.					
					2	Not used.					
			1	Predictive control type	0	Predictive control for tracking	1	---	---	Offline	---
					1	Predictive control for positioning					
			2	Not used.	2	(Do not change the setting.)	2	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn151	Predictive control acceleration/deceleration gain	2	Adjusts acceleration and deceleration response for predictive control.				100	%	0 to 300	Online	---
Pn152	Predictive control weighting ratio	2	Adjusts position deviation for predictive control.				100	%	0 to 300	Online	---
Pn1A0	Servo rigidity	2	Adjusts the Servo rigidity for the No. 1 gain.				60	%	1 to 500	Online	---
Pn1A1	Servo rigidity 2	2	Adjusts the Servo rigidity for the No. 2 gain.				60	%	1 to 500	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn1A2	Speed feedback filter time constant	2	Sets the filter time constant for No. 1 gain speed feedback.				72	×0.01 ms	30 to 3200	Online	---
Pn1A3	Speed feedback filter time constant 2	2	Sets the filter time constant for No. 2 gain speed feedback.				72	×0.01 ms	30 to 3200	Online	---
Pn1A4	Torque command filter time constant 2	2	Sets the filter time constant for the torque command.				36	×0.01 ms	0 to 2500	Online	---
Pn1A7	Utility control switches	2	0	Integral compensation processing	0	Integral compensation processing not executed.	1	---	---	Online	---
					1	Integral compensation processing executed.					
					2	Integral compensation is executed for No. 1 gain and not for No. 2 gain for less-deviation gain switching.					
					3	Integral compensation is executed for No. 2 gain and not for No. 1 gain for less-deviation gain switching.					
			1	Not used.	2	(Do not change the setting.)	2	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	1	(Do not change the setting.)	1	---	---	---	---
Pn1A9	Utility integral gain	2	Adjusts the auxiliary integral responsive.				37	Hz	0 to 500	Online	---
Pn1AA	Position proportional gain	2	Adjusts the position proportional responsive.				60	Hz	0 to 500	Online	---
Pn1AB	Speed integral gain	2	Adjusts the speed integral responsive.				0	Hz	0 to 500	Online	---
Pn1AC	Speed proportional gain	2	Adjusts the speed proportional responsive.				120	Hz	0 to 2000	Online	---
Pn1B5	Not used.	---	(Do not change the setting.)				150	---	---	---	---

Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn200	Not used.	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn205	Absolute encoder multi-turn limit setting	2	Sets the multi-turn limit for when a Servomotor with an absolute encoder is used.				65535	Rotation	0 to 65535	Offline	---
Pn207	Position control settings 2	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			2	Backlash compensation selection	0	Disabled	0	---	---	Offline	---
					1	Compensates to forward rotation side.					
					2	Compensates to reverse rotation side.					
			3	INP 1 output timing	0	When the position deviation is below the INP1 range (Pn522).	0	---	---	Offline	---
					1	When the position deviation is below the INP1 range (Pn522) and also the command after the position command filter is 0.					
					2	When the absolute value for the position deviation is below the INP1 range (Pn522) and also the position command input is 0.					
Pn209	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn20A	Not used.	---	(Do not change the setting.)				32768	---	---	---	---
Pn20E	Electronic gear ratio G1 (numerator)	4	Sets the pulse rate for the command pulses and Servomotor movement distance. $0.001 \leq G1/G2 \leq 1000$				4	---	1 to 1073741824	Offline	---
Pn210	Electronic gear ratio G2 (denominator)	4					1	---	1 to 1073741824	Offline	---
Pn212	Encoder divider rate	4	Sets the number of output pulses per Servomotor rotation.				1000	Pulses /rotation	16 to 1073741824	Offline	---
Pn214	Backlash compensation amount	2	Mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven)				0	Command unit	–32767 to 32767	Online	---
Pn215	Backlash compensation time constant	2	Sets the backlash compensation time constant.				0	×0.01 ms	0 to 65535	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn216	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn217	Not used.	---	(Do not change the setting.)				0	---	---	---	---
Pn281	Not used.	---	(Do not change the setting.)				20	---	---	---	---

Speed Control Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn300	Not used.	---	(Do not change the setting.)				600	---	---	---	---
Pn301	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn302	Not used.	---	(Do not change the setting.)				200	---	---	---	---
Pn303	Not used.	---	(Do not change the setting.)				300	---	---	---	---
Pn304	Jog speed	2	Sets rotation speed during jog operation (using Servo Drive's personal computer monitoring software)				500	r/min	0 to 10000	Online	---
Pn305	Soft start acceleration time	2	Sets acceleration time during speed control soft start.				0	ms	0 to 10000	Online	---
Pn306	Soft start deceleration time	2	Sets deceleration time during speed control soft start.				0	ms	0 to 10000	Online	---
Pn307	Not used.	---	(Do not change the setting.)				40	---	---	---	---
Pn308	Speed feedback filter time constant	2	Sets constant during filter of speed feedback.				0	×0.01 ms	0 to 65535	Online	---
Pn310	Vibration detection switches	2	0	Vibration detection selection	0	Vibration detection not used.	0	---	---	Online	---
					1	Gives warning (A.911) when vibration is detected.					
					2	Gives alarm (A.520) when vibration is detected.					
			1	Not used.	---	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	---	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	---	(Do not change the setting.)	0	---	---	---	---
Pn311	Vibration detection sensitivity	2	Sets the vibration detection sensitivity.				100	%	50 to 500	Online	---
Pn312	Vibration detection level	2	Sets the vibration detection level				50	r/min	0 to 500	Online	---

Torque Control (Torque Limit) Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn400	Not used.	---	(Do not change the setting.)				30	---	---	---	---
Pn401	1st step 1st torque command filter time constant	2	Sets the filter time constant for internal torque commands.				40	×0.01 ms	0 to 65535	Online	---
Pn402	Forward torque limit	2	Forward rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn403	Reverse torque limit	2	Reverse rotation output torque limit (rated torque ratio).				350	%	0 to 800	Online	---
Pn404	Forward rotation external current limit	2	Output torque limit during input of forward rotation current limit (rated torque ratio)				100	%	0 to 800	Online	---
Pn405	Reverse rotation external current limit	2	Output torque limit during input of reverse rotation current limit (rated torque ratio)				100	%	0 to 800	Online	---
Pn406	Emergency stop torque	2	Deceleration torque when an error occurs (rated torque ratio)				350	%	0 to 800	Online	---
Pn407	Speed limit	2	Sets the speed limit in torque control mode.				3000	r/min	0 to 10000	Online	---
Pn408	Torque command setting	2	0	Selects notch filter 1 function.	0	Notch filter 1 not used.	0	---	---	Online	---
					1	Notch filter 1 used for torque commands.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Selects notch filter 2 function.	0	Notch filter 2 not used.	0	---	---	Online	---
					1	Notch filter 2 used for torque commands.					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn409	Notch filter 1 frequency	2	Sets notch filter 1 frequency for torque command.				2000	Hz	50 to 2000	Online	---
Pn40A	Notch filter 1 Q value	2	Sets Q value of notch filter 1.				70	×0.01	50 to 1000	Online	---
Pn40C	Notch filter 2 frequency	2	Sets the notch filter 2 frequency for torque commands.				2000	Hz	50 to 2000	Online	---
Pn40D	Notch filter 2 Q value	2	Sets Q value of notch filter 2.				70	×0.01	50 to 1000	Online	---
Pn40F	2nd step 2nd torque command filter frequency	2	Sets the filter frequency for internal torque commands.				2000	Hz	100 to 2000	Online	---
Pn410	2nd step 2nd torque command filter Q value	2	Sets the torque command filter Q value.				70	×0.01	50 to 1000	Online	---
Pn411	3rd step torque command filter time constant	2	Sets the filter time constant for internal torque commands.				0	μs	0 to 65535	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn412	1st step 2nd torque command filter time constant	2	Sets the filter time constant for No. 2 gain internal torque commands.				100	×0.01 ms	0 to 65535	Online	---
Pn413	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn414	Not used.	---	(Do not change the setting.)				100	---	---	---	---
Pn420	Damping for vibration suppression on stopping	2	Sets the vibration suppression value while stopped.				100	%	10 to 100	Online	---
Pn421	Vibration suppression starting time	2	Sets the time from when the position command becomes 0 until damping for vibration suppression on stopping begins.				1000	ms	0 to 65535	Online	---
Pn422	Gravity compensation torque	2	Sets the gravity compensation torque.				0	×0.01 %	–20000 to 20000	Online	---
Pn456	Sweep torque command amplitude	2	Sets the sweep torque command amplitude.				15	%	1 to 800	Online	---

I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn501	Not used.	---	(Do not change the setting.)				10	---	---	---	---
Pn502	Rotation speed for motor rotation detection	2	Sets the number of rotations for the Servomotor rotation detection output (TGON).				20	r/min	1 to 10000	Online	---
Pn503	Speed conformity signal output width	2	Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP).				10	r/min	0 to 100	Online	---
Pn506	Brake timing 1	2	Sets the delay from the brake command to the Servomotor turning OFF.				0	×10 ms	0 to 50	Online	---
Pn507	Brake command speed	2	Sets the number of rotations for outputting the brake command.				100	r/min	0 to 10000	Online	---
Pn508	Brake timing 2	2	Sets the delay time from the Servomotor turning OFF to the brake command output.				50	×10 ms	10 to 100	Online	---
Pn509	Momentary hold time	2	Sets the time during which alarm detection is disabled when a power failure occurs.				20	ms	20 to 1000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selections 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	POT (forward drive prohibited input) signal Input terminal allocation	0	Allocated to CN1, pin 13: Valid for low input	1	---	---	Offline	Standard setting: 1
					1	Allocated to CN1, pin 7: Valid for low input					
					2	Allocated to CN1, pin 8: Valid for low input					
					3	Allocated to CN1, pin 9: Valid for low input					
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 13: Valid for high input					
					A	Allocated to CN1, pin 7: Valid for high input					
					B	Allocated to CN1, pin 8: Valid for high input					
					C	Allocated to CN1, pin 9: Valid for high input					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					
Pn50B	Input signal selections 2	2	0	NOT (reverse drive prohibited input) signal Input terminal allocation	0 to F	Same as Pn50A.3	2	---	---	Offline	Standard setting: 2
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50C	Input signal selections 3	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50D	Input signal selections 4	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn50E	Output signal selections 1	2	0	INP1 (positioning completed 1) signal output terminal allocation	0	Not used.	0	---	---	Offline	Standard setting: 0
					1	Allocated to CN1 pins 1, 2					
					2	Allocated to CN1 pins 23, 24					
					3	Allocated to CN1 pins 25, 26					
			1	VCMP (speed conformity) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	TGON (servomotor rotation detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			3	READY (servo ready) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
Pn50F	Output signal selections 2	2	0	CLIMT (current limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	VLIMT (speed limit detection) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			2	BKIR (brake interlock) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 1
			3	WARN (warning) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn510	Output signal selections 3	2	0	INP2 (positioning completed 2) signal output terminal allocation	0 to 3	Same as Pn50E.0	0	---	---	Offline	Standard setting: 0
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn511	Input signal selections 5	2	0	DEC signal input terminal allocation	0	Allocated to CN1, pin 13: Valid for low input	3	---	---	Offline	Standard setting: 3
					1	Allocated to CN1, pin 7: Valid for low input					
					2	Allocated to CN1, pin 8: Valid for low input					
					3	Allocated to CN1, pin 9: Valid for low input					
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9	Allocated to CN1, pin 13: Valid for high input					
					A	Allocated to CN1, pin 7: Valid for high input					
					B	Allocated to CN1, pin 8: Valid for high input					
					C	Allocated to CN1, pin 9: Valid for high input					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn511	Input signal selections 5	2	1	EXT1 signal input terminal allocation	0 to 3	Always disabled.	4	---	---	Offline	Standard setting: 4
					4	Allocated to CN1, pin 10: Valid for low input					
					5	Allocated to CN1, pin 11: Valid for low input					
					6	Allocated to CN1, pin 12: Valid for low input					
					7	Always enabled.					
					8	Always disabled.					
					9 to C	Always disabled.					
					D	Allocated to CN1, pin 10: Valid for high input					
					E	Allocated to CN1, pin 11: Valid for high input					
					F	Allocated to CN1, pin 12: Valid for high input					
			2	EXT2 signal input terminal allocation	0 to F	Same as Pn511.1	5	---	---	Offline	Standard setting: 5
			3	EXT3 signal input terminal allocation	0 to F	Same as Pn511.1	6	---	---	Offline	Standard setting: 6
Pn512	Output signal reverse	2	0	Output signal reverse for CN1 pins 1, 2	0	Not reversed.	0	---	---	Offline	---
					1	Reversed.					
			1	Output signal reverse for CN1 pins 23, 24	0, 1	Same as above	0	---	---	Offline	---
			2	Output signal reverse for CN1 pins 25, 26	0, 1	Same as above	0	---	---	Offline	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn513	Not used.	---	(Do not change the setting.)				0321	---	---	---	---
Pn515	Not used.	---	(Do not change the setting.)				8888	---	---	---	---
Pn51B	Not used.	---	(Do not change the setting.)				1000	---	---	---	---
Pn51E	Deviation counter overflow warning level	2	Sets the detection level for the deviation counter overflow warning.				100	%	10 to 100	Online	---
Pn520	Deviation counter overflow level	4	Sets the deviation counter overflow alarm detection level.				262144	Command unit	1 to 1073741823	Online	---
Pn522	Positioning completed range 1	4	Setting range for positioning completed range 1 (INP1)				3	Command unit	0 to 1073741823	Online	---
Pn524	Positioning completed range 2	4	Setting range for positioning completed range 2 (INP2)				3	Command unit	1 to 1073741823	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn526	Deviation counter overflow level at Servo-ON	4	Sets the deviation counter overflow alarm detection level for Servo ON.				262144	Command unit	1 to 1073741823	Online	---
Pn528	Deviation counter overflow warning level at Servo-ON	2	Sets the deviation counter overflow warning detection level for Servo ON.				100	%	10 to 100	Online	---
Pn529	Speed limit level at Servo-ON	2	Sets the speed limit for when the Servo turns ON with position deviation accumulated.				10000	r/min	0 to 10000	Online	---
Pn52A	Not used.	---	(Do not change the setting.)				20	---	---	---	---
Pn52F	Not used.	---	(Do not change the setting.)				FFF	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn530	Program JOG operation related switches	2	0	Program JOG operating pattern	0	(Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536	0	---	---	Online	---
					1	(Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					2	Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					3	(Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536					
					4	(Waiting time Pn535 → Forward movement Pn531 → Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536					
					5	(Waiting time Pn535 → Reverse movement Pn531 → Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn531	Program JOG movement distance	4	Sets the program JOG movement distance.				32768	Command unit	1 to 1073741824	Online	---
Pn533	Program JOG movement speed	2	Sets the program JOG operation movement speed.				500	r/min	1 to 10000	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn534	Program JOG acceleration/deceleration time	2	Sets the acceleration/deceleration time for program JOG operation.				100	ms	2 to 10000	Online	---
Pn535	Program JOG waiting time	2	Sets the delay time from the program JOG operation start input until operation starts.				100	ms	0 to 10000	Online	---
Pn536	Number of program JOG movements	2	Sets the number of repetitions of the program JOG operations.				1	Times	1 to 1000	Online	---
Pn540	Gain limit	2	Sets the gain limit.				2000	×0.1 Hz	10 to 2000	Online	---
Pn550	Analog monitor 1 offset voltage	2	Sets the analog monitor 1 offset voltage.				0	×0.1 V	–10000 to 10000	Online	---
Pn551	Analog monitor 2 offset voltage	2	Sets the analog monitor 2 offset voltage.				0	×0.1 V	–10000 to 10000	Online	---

Other Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn600	Regeneration resistor capacity	2	Setting for regeneration resistance load ratio monitoring calculations	0	×10 W	0 to (varies by model)	Online	---

Control Function Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	MECHATROLINK communications check mask	0	Detects both communications errors (A.E6□) and synchronization errors (A.E5□).	0	---	---	Online	Always set to 0.
					1	Ignores communications errors (A.E6□).					
					2	Ignores synchronization errors (A.E5□).					
					3	Ignores communications errors (A.E6□) and synchronization errors (A.E5□).					
			1	Warning check mask	0	Detects all parameter setting warnings (A.94□), MECHATROLINK command warnings (A.95□), and communications errors (A.96□).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameter setting warning (A. 94□).					
					2	Ignores command warning (A. 95□).					
					3	Ignores parameter setting warning (A. 94□) and command warning (A. 95□).					
					4	Ignores communications warning (A. 96□).					
					5	Ignore setting warning (A. 94□) and communications warning (A. 96□).					
					6	Ignores command warning (A. 95□) and communications warning (A. 96□).					
					7	Ignores setting warning (A. 94□), command warning (A. 95□), and communications warning (A. 96□).					
			2	Communications error count at single transmission	0 to F	Detects communications errors (A.E60) if they occur consecutively for the set value plus two times.	0	---	---	Online	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn801	Function selection application 6 (software LS)	2	0	Software limit function	0	Software limit enabled.	3	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Forward/reverse software limits disabled.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using reference	0	No software limit check using reference	0	---	---	Online	Always set to 0.
					1	Software limit check using reference					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn802	Not used.	---	(Do not change the setting.)	0000	---	---	---	---
Pn803	Zero point width	2	Sets the origin position detection range.	10	Command unit	0 to 250	Online	---
Pn804	Forward software limit	4	Sets the software limit for the positive direction.	819,191,808	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the software limit for the negative direction.	–819,191,808	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn808	Absolute encoder zero point position offset	4	Sets the encoder position and machine coordinate system offsets for when an absolute encoder is used.	0	Command unit	–1,073,741,823 to 1,073,741,823	Offline	---
Pn80A	First step linear acceleration constant	2	Sets the step 1 acceleration for when two-step acceleration is used.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80B	Second step linear acceleration constant	2	Sets the step 2 acceleration for when two-step acceleration is executed, or the one-step acceleration constant for when one-step acceleration is executed.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80C	Acceleration constant switching speed	2	Sets the switching speed for the step 1 and step 2 acceleration when two-step acceleration is executed.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn80D	First step linear deceleration constant	2	Sets the step 1 deceleration for when two-step deceleration is used.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Second step linear deceleration constant	2	Sets the step 2 deceleration for when two-step deceleration is executed, or the one-step deceleration constant for when one-step deceleration is executed.	100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80F	Deceleration constant switching speed	2	Sets the switching speed for the step 1 and step 2 deceleration when two-step deceleration is executed.	0	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn810	Exponential acceleration/ deceleration bias	2	Sets the bias for when an exponential filter is used for the position command filter.	0	Command units/s	0 to 32767	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn811	Exponential acceleration/ deceleration time constant	2	Sets the time constant for when an exponential filter is used for the position command filter.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn812	Moving average time	2	Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter.	0	×0.1 ms	0 to 5100	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn813	Reserved.	---	(Do not change the setting.)	0	---	---	---	---
Pn814	Final travel distance for external positioning	4	Sets the distance from the external signal input position when external positioning is executed.	100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode settings	2	0	Zero point return direction	0	Forward direction	0	---	---	Online	Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse direction					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the distance from the latch signal input position to the origin, for when origin search is executed.				100	Command unit	–1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn81B to Pn825	Not used.	---	(Do not change the setting.)				0000	---	---	---	---
Pn900 to Pn910	Not used.	---	(Do not change the setting.)				---	---	---	---	---
Pn920 to Pn95F	Not used.	---	(Do not change the setting.)				----	---	---	---	---

R7D-ZN□-ML2 SMARTSTEP Junior Servo Drive with Built-in MECHATROLINK-II Communications

Function Selection Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn000	Function selection basic switches	2	0	Reverse rotation	0	CCW direction is taken for positive command	0	---	---	Offline	---
					1	CW direction is taken for negative command					
					2 to 3	Not used.					
			1	Not used.	1	(Do not change the setting.)	0	---	---	---	---
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn00A	Filter settings	2	Sets the filter time constants. When using this parameter, turn ON bit 4 of SW2 on the SMARTSTEP Junior Servo Drive.				0000	---	0000 to 000F	Online	---

Position Control Parameters

Parameter No.	Parameter name	Parameter size	Contents	Default setting	Unit	Setting range	Enable setting	Details
Pn20E	Electronic gear ratio G1(numerator)	4	Sets the pulse rate for the command pulses and Servomotor travel distance. $0.01 \leq G1/G2 \leq 100$	1	---	1 to 1073741824	Offline	---
Pn210	Electronic gear ratio G2 (denominator)	4		1	---	1 to 1073741824	Offline	---

I/O and Status Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn50A	Input signal selection 1	2	0	Not used.	1	(Do not change the setting.)	1	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	POT (forward drive prohibited input) signal input terminal allocation	2	Allocated to CN1, pin 4: Valid for low input	2	---	---	Offline	Standard setting: 2
					8	Always invalid.					
Pn50B	Input signal selection 2	2	0	NOT (reverse drive prohibited input) signal input terminal allocation	3	Allocated to CN1, pin 3: Valid for low input	3	---	---	Offline	Standard setting: 3
					8	Always invalid.					
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn515	Input signal selection 7	2	0	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			1	Not used.	8	(Do not change the setting.)	8	---	---	---	---
			2	Emergency stop (STOP) signal input pin allocation	4	Allocated to CN1, pin 6: Valid for low input	4	---	---	Offline	Standard setting: 4
					8	Always invalid.	8				
			3	Not used.	8	(Do not change the setting.)	8	---	---	---	---
Pn522	Positioning completion range 1	4	Sets the width of the positioning completed range.				10	Command unit	0 to 1,073,741,824	Online	---
Pn524	Positioning completion range 2	4	Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag.				100	Command unit	0 to 1,0737,41,824	Online	---

Control Function Parameters

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn800	Communications control	2	0	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			1	Warning check mask	0	Detects all parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96).	4	---	---	Online	Always set to 4 or 0.
					1	Ignores parameter setting warning (A.94).					
					2	Ignores command warning (A.95).					
					3	Ignores setting warning (A.94) and command warning (A.95).					
					4	Ignores communications warning (A.96).					
					5	Ignore setting warning (A.94) and communications errors (A.96).					
					6	Ignores command warnings (A.95) and communications errors (A.96).					
					7	Ignores setting warning (A.94, command warning (A.95), and communications errors (A.96).					
			2	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn801	Function selection application 6 (software LS)	2	0	Software limit function	0	Software limit enabled.	3	---	---	Online	---
					1	Forward software limit disabled.					
					2	Reverse software limit disabled.					
					3	Forward/reverse software limits disabled.					
			1	Not used.	0	(Do not change the setting.)	0	---	---	---	---
			2	Software limit check using reference	0	No software limit check using reference	0	---	---	Online	Always set to 0.
					1	Software limit check using reference					
			3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn803	Zero point width	2	Sets the origin position detection range.				10	Command unit	0 to 250	Online	---

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn804	Forward software limit	4	Sets the software limit for the positive direction.				1,073,741,823	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn806	Reverse software limit	4	Sets the software limit for the negative direction.				–1,073,741,823	Command unit	–1,073,741,823 to 1,073,741,823	Online	---
Pn80B	Linear acceleration constant	2	Sets the acceleration constant for the acceleration/deceleration curves for positioning.				100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn80E	Linear deceleration constant	2	Sets the deceleration constant for the acceleration/deceleration curves for positioning.				100	×10,000 command units/s^2	1 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn814	Final travel distance for external positioning	4	Sets the distance from the external signal input position when external positioning is executed.				100	Command unit	–1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).

Parameter No.	Parameter name	Parameter size	Contents				Default setting	Unit	Setting range	Enable setting	Details
			Digit No.	Name	Setting	Explanation					
Pn816	Zero point return mode settings	2	0	Zero point return direction	0	Forward direction	0				Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
					1	Reverse direction					
			1 to 3	Not used.	0	(Do not change the setting.)	0	---	---	---	---
Pn817	Zero point return approach speed 1	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				50	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn818	Zero point return approach speed 2	2	Sets the origin search speed after the deceleration limit switch signal turns ON.				5	×100 command units/s	0 to 65535	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn819	Final travel distance to return to zero point	4	Sets the distance from the latch signal input position to the origin, for when origin search is executed.				100	Command unit	−1,073,741,823 to 1,073,741,823	Online	Settings can be changed when the axes are stopped (Busy Flag for each axis = 0).
Pn820 to Pn823	Not used.	---	(Do not change the setting.)				0000	---	----	---	---

Appendix C
Operation Area I/O Allocations

Common Operating Memory Area

Common Operating Output Memory Area Allocations

n = CIO 1500 + (unit number × 25)

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	n	00	---	UNIT ERROR RESET	↑: Clears the Unit common error that occurred.
		01	Data transfer commands	WRITE DATA	↑: Starts writing data.
		02		READ DATA	↑: Starts reading data
		03		SAVE DATA	↑: Starts saving data
		04 to 15	---	Not used (reserved by the system).	---
	n+1	00	Communications control commands	CONNECT	↑: Establishes connection. ↓: Releases connection.
		01 to 05		Reserved by the system.	---
		06		WRITE BACKUP DATA	↑: Starts writing backup data.
		07		READ BACKUP DATA	↑: Starts reading backup data.
		08 to 14		Not used (reserved by the system).	---
		15		REJOIN (See note.)	↑: Starts processing for axes to rejoin the connection.
	n+2	---		Axes to connect (See note.)	Sets the following for the axes registered in the scan list (bits 0 to 15 correspond to axes 1 to 16). 0: Start MECHATROLINK communications. 1: Do no start MECHATROLINK communications.
	n+3 to n+5	---	---	Not used (reserved by the system).	---

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	n+6	---	Operating data for data transfer	Number of write words	Specifies the number of words to be written to the PCU.
	n+7	---		Write source area	Specifies the area of the data to be written to the PCU. 00B0 hex: CIO Area 00B1 hex: WR Area 00B2 hex: HR Area 00B3 hex: AR Area 0082 hex: DM Area 005□ hex: EM Area □: EM bank No.= 0 to 9, A, B, C
	n+8	---		Write source word	Specifies in hexadecimal the beginning word of the area for the data to be written to the PCU.
	n+9	---		Write destination address	Specifies the write destination address in the PCU.
	n+10	---		Number of read words	Specifies the number of words to be read from the PCU.
	n+11	---		Read source address	Specifies the read source address in the PCU.
	n+12	---		Read destination area	Specifies the area used to store the data read from the PCU. 00B0 hex: CIO Area 00B1 hex: WR Area 00B2 hex: HR Area 00B3 hex: AR Area 0082 hex: DM Area 005□ hex: EM Area □: EM bank No.= 0 to 9, A, B, C
	n+13	---		Read destination word	Specifies in hexadecimal the beginning word of the area where the data read from the PCU is stored.
	n+14	---	---	Not used (reserved by the system).	---

Note The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.

Common Operating Input Memory Area Allocations

n = CIO 1500 + (unit number × 25)

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	n+15	00 to 11	PCU common status words	Not used (reserved by the system).	---
		12		Unit Error Flag	0: Unit common error has not occurred. 1: Unit common error has occurred.
		13		Not used (reserved by the system).	---
		14		Data Transferring Flag	0: Powerup, transfer completed, or transfer failed. 1: Transferring data.
		15		Not used (reserved by the system).	---
	n+16	00 to 11		Reserved by the system.	---
		12		Memory Card Transfer Error	0: No Memory Card transfer error has occurred. 1: A Memory Card transfer error has occurred.
		13		Reserved by the system.	---
		14		Unit Busy Flag	0: PCU is not busy. 1: PCU is busy.
		15		Connection Status Flag	0: MECHATROLINK communications stopped. 1: MECHATROLINK communications executing.
	n+17 to n+20	---	---	Reserved by the system.	---
	n+21	---		Unit error code	Shows the error code for the Unit common error that occurred.

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	n+22	00	Axis communications status bits	Axis 1 communications status	Bits 00 to 15 correspond to the communications status for axes 1 to 16. The bits will turn ON if the corresponding axes registered in the scan list are communicating normally. 0: Communications for the corresponding axis have stopped, or the axis not registered in scan list. 1: The corresponding axis is communicating.
		01		Axis 2 communications status	
		02		Axis 3 communications status	
		03		Axis 4 communications status	
		04		Axis 5 communications status	
		05		Axis 6 communications status	
		06		Axis 7 communications status	
		07		Axis 8 communications status	
		08		Axis 9 communications status	
		09		Axis 10 communications status	
		10		Axis 11 communications status	
		11		Axis 12 communications status	
		12		Axis 13 communications status	
		13		Axis 14 communications status	
		14		Axis 15 communications status	
		15		Axis 16 communications status	
	n+23 to n+24	---	---	Not used (reserved by the system).	---

Axis Operating Output Memory Area Allocations

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	a	00	Direct operation commands	LINEAR INTERPOLATION SETTING (See note 1.)	↑: Starts setting linear interpolation.
		01		LINEAR INTERPOLATION START (See note 1.)	↑: Starts linear interpolation. (Valid only when LINEAR INTERPOLATION SETTING = 1.)
		02		Not used (reserved by the system).	---
		03		ABSOLUTE MOVEMENT	↑: Starts absolute movement.
		04		RELATIVE MOVEMENT	↑: Starts relative movement.
		05		INTERRUPT FEEDING	1: Enables interrupt feeding.
		06	Origin positioning commands	ORIGIN SEARCH	↑: Starts origin search.
		07		ORIGIN RETURN	↑: Starts origin return.
		08		PRESENT POSITION PRESET	↑: Starts present position preset.
		09	Commands for special functions	JOG	↑: Starts jogging. ↓: Stops jogging.
		10		Direction designation	0: Forward rotation direction 1: Reverse rotation direction
		11		Not used (reserved by the system).	---
		12		ERROR RESET	↑: Clears the axis error that occurred.
		13		DEVIATION COUNTER RESET (See note 4.)	↑: Starts DEVIATION COUNTER RESET.
		14		Override Enable Bit	0: Override disabled. 1: Override enabled.
		15		DECELERATION STOP	↑: Starts deceleration stop.
	a+1	00	Commands for special functions	SERVO LOCK	↑: Starts SERVO LOCK.
		01		SERVO UNLOCK	↑: Starts SERVO UNLOCK.
		02		SPEED CONTROL	↑: Starts speed control.
		03		TORQUE CONTROL	↑: Starts torque control.
		04 to 10		Not used (reserved by the system).	---
		11	Servo Parameter transfer commands	DEVICE SETUP	↑: Starts device setup for the Servo Drive.
		12		WRITE SERVO PARAMETER	↑: Starts writing Servo Parameter.
		13		READ SERVO PARAMETER	↑: Starts reading Servo Parameter.
		14		SAVE SERVO PARAMETER	↑: Starts writing Servo Parameter to non-volatile memory.
		15	Special command	EMERGENCY STOP	↑: Starts emergency stop.

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	a+2	---	Operating data for position control	Position command value (rightmost word)	Position command value (rightmost word) Position command value (leftmost word) Unit: command unit
	a+3	---		Position command value (leftmost word)	
	a+4	---		Speed command value (rightmost word)	Speed command value (rightmost word) Speed command value (leftmost word) Unit: Command units/s
	a+5	---		Speed command value (leftmost word)	
	a+6	---	Speed control data	Speed command value for speed control (rightmost word)	Speed command value (rightmost word) Speed command value (leftmost word) Unit: 0.001%
	a+7	---		Speed command value for speed control (leftmost word)	
	a+8	---	Torque control data	Torque command value (rightmost word)	Torque command value (rightmost word) Torque command value (leftmost word) Unit: 0.001%
	a+9	---		Torque command value (leftmost word)	
	a+10	---	Position/ speed/ torque control data	Option command value 1 (rightmost word)	Linear interpolation: Interpolation acceleration time, Unit: ms Speed control: Torque limit/torque feed forward, Unit: % Torque control: Speed limit, Unit: 0.001%
	a+11	---		Option command value 1 (leftmost word)	
	a+12	---		Option command value 2 (rightmost word)	Linear interpolation: Interpolation deceleration time, Unit: ms Speed control: Torque limit, Unit: %
	a+13	---		Option command value 2 (leftmost word)	
	a+14	---	Operating data for special function	Override	Override ratio (unit: 0.01%)
	a+15	00 to 03	Operating data for expanded monitoring	Monitor 1 type	Specifies monitor type for monitor 1.
		04 to 07		Monitor 2 type	Specifies monitor type for monitor 2.
		08 to 15		Not used (reserved by the system).	---

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	a+16	00 to 02	---	Reserved by the system.	---
		03	Acceleration/deceleration curves	Exponential curve designation	1: Use exponential acceleration/deceleration curve.
		04		S-curve designation	1: Use S-curve acceleration/deceleration curve.
		05 to 13	---	Reserved by the system.	---
		14	Torque limit	Forward rotation current limit designation	1: Use forward torque limit.
		15		Reverse rotation current limit designation	1: Use reverse torque limit.
	a+17	---	Operating data for transferring Servo Parameters	Servo Parameter No.	Specifies the parameter number of the Servo Drive that will transfer the data.
	a+18	---		Parameter size	Specifies the data length of the parameter to be transferred in byte units.
	a+19	---		Write data (rightmost word)	Specifies the data to be written to the Servo Drive.
	a+20	---		Write data (leftmost word)	
	a+21	00	Linear interpolation data	Interpolation axis designation for axis 1 (See note 2.)	Specify the axes for linear interpolation for combinations of axes 1 to 4. Bits 00 to 03 correspond to axes 1 to 4. 0: Not an interpolation axis. 1: Interpolation axis.
		01		Interpolation axis designation for axis 2 (See note 2.)	
		02		Interpolation axis designation for axis 3 (See note 2.)	
		03		Interpolation axis designation for axis 4 (See note 2.)	
		04		Interpolation axis designation for axis 5 (See note 3.)	Specify the axes for linear interpolation for combinations of axes 5 to 8. Bits 04 to 07 correspond to axes 5 to 8. 0: Not an interpolation axis. 1: Interpolation axis.
		05		Interpolation axis designation for axis 6 (See note 3.)	
		06		Interpolation axis designation for axis 7 (See note 3.)	
		07		Interpolation axis designation for axis 8 (See note 3.)	
		08 to 15		Not used (reserved by the system).	---

I/O	Word	Bits	Category	Name	Function
Output (CPU Unit to PCU)	a+22	00	Linear interpolation data	Interpolation position designation for axis 1 (See note 2.)	Specify absolute or relative positioning for the axes for linear interpolation. Bits 00 to 03 correspond to axes 1 to 4. 0: Absolute positioning 1: Relative positioning
		01		Interpolation position designation for axis 2 (See note 2.)	
		02		Interpolation position designation for axis 3 (See note 2.)	
		03		Interpolation position designation for axis 4 (See note 2.)	
		04		Interpolation position designation for axis 5 (See note 3.)	Specify absolute or relative positioning for the axes for linear interpolation. Bits 04 to 07 correspond to axes 5 to 8. 0: Absolute positioning 1: Relative positioning
		05		Interpolation position designation for axis 6 (See note 3.)	
		06		Interpolation position designation for axis 7 (See note 3.)	
		07		Interpolation position designation for axis 8 (See note 3.)	
		08 to 15		Not used (reserved by the system).	---
	a+23	---		Interpolation speed command value (rightmost word) (See note 1.)	Interpolation speed command value (rightmost word)
	a+24	---		Interpolation speed command value (leftmost word) (See note 1.)	Interpolation speed command value (leftmost word) Unit: Command units/s

Note (1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.

Axis Operating Input Memory Area Allocations

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	b	00	Axis Control Status Flags	Receiving Command Flag	0: Command reception enabled. ↑: Command reception started. 1: Receiving command (command reception disabled)
		01 to 04		Not used (reserved by the system).	Always 0.
		05		PCU Positioning Completed Flag	↑: Positioning is completed.
		06		No Origin Flag	0: Origin established. 1: No origin established.
		07		Origin Stop Flag	0: Outside origin range. 1: Within origin range.
		08 to 10		Not used (reserved by the system).	Always 0.
		11		Warning Flag	0: No warning has occurred. 1: Warning has occurred.
		12		Error Flag	0: No axis error has occurred. 1: Axis error has occurred.
		13		Busy Flag	0: Axis is not busy. 1: Axis is busy.
		14		Servo Parameter Transferring Flag	0: Powerup, transfer completed, or transfer failed. 1: Servo Parameter transferring.
		15		Stop Execution Flag	↑: Stop operation completed.

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	b+1	00 to 02	Servo Status Flags	Reserved by the system.	Used by the PCU system.
		03		Servo ON Flag (SVON)	0: Servo unlocked. 1: Servo locked.
		04		Main Power ON Flag (PON)	0: Main circuit power supply OFF 1: Main circuit power supply ON
		05 and 06		Reserved by the system.	Used by the PCU system.
		07		Position Completed (PSET) Flag/Speed Conformity (V-CMP) Flag	During position control: Position Completed Flag 0: Servo Drive executing position control command or the position is outside *Positioning Completion Range 1*. 1: Servo Drive finished executing position control command and the position is within *Positioning Completion Range 1*. During speed control: Speed Conformity Flag 0: Speed does not match the speed designation for speed control. 1: Speed matches the speed designation for speed control.
		08		Distribution Completed (DEN) Flag/ Zero Speed (ZSPD) Flag	During position control: Distribution Completed Flag 0: Servo Drive is executing a position control command. 1: Servo Drive has completed executing a position control command. During speed control: Zero Speed Flag 0: Not at zero speed. 1: Detecting zero speed.
		09		Torque Limit (T_LIM) Status Flag	0: Torque limit function disabled. 1: Torque limit function enabled.
		10		Reserved by the system.	Used by the PCU system.
		11		Positioning Proximity (NEAR) Flag/ Speed Limit (V_LIM) Status Flag	During position control: Positioning Proximity Flag 0: Outside *Positioning Completion Range 2*. 1: Within *Positioning Completion Range 2*. During torque control: Speed Limit Status Flag 0: Speed limit function disabled. 1: Speed limit function enabled.
		12		Forward Software Limit Flag (P_SOT)	0: Within forward software limit range. 1: Forward software limit range exceeded.
		13		Reverse Software Limit Flag (N_SOT)	0: Within reverse software limit range. 1: Reverse software limit range exceeded.
		14 to 15		Reserved by the system.	Used by the PCU system.
	b+2	---	---	Reserved by the system.	Used by the PCU system.

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	b+3	00	External I/O status	Forward rotation limit input	Returns the status of I/O signals for each axis. 1: Signal valid 0: Signal invalid The external I/O status shows the enabled/disabled status of signals used for PCU control. This status is different from the electrical ON/OFF status of the I/O signals.
		01		Reverse rotation limit input	
		02		Origin proximity input	
		03		Encoder Phase A input	
		04		Encoder Phase B input	
		05		Encoder Phase Z input	
		06		External latch signal 1 input	
		07		External latch signal 2 input	
		08		External latch signal 3 input	
		09		Brake output	
		10		Emergency stop input (See note 2.)	
		11 to 15		Reserved by the system.	
	b+4	---	Errors	Axis error code	Displays axis error code/warning code for each axis.
	b+5	00 to 03	Expanded monitoring	Monitor 1 type	Shows monitor type for monitor 1.
		04 to 07		Monitor 2 type	Shows monitor type for monitor 2.
		08 to 15		Not used (reserved by the system).	Always 0.
	b+6	---	Present position	Feedback present position (rightmost word)	Present position: Feedback present position (rightmost word) Feedback present position (leftmost word)
	b+7	---		Feedback present position (leftmost word)	
	b+8	---		Command present position (rightmost word)	Present position: Command position (rightmost word) Command position (leftmost word)
	b+9	---		Command present position (leftmost word)	
	b+10	---	Expanded monitoring	Monitor 1 (rightmost word)	Monitor value specified for monitor 1 type.
	b+11	---		Monitor 1 (leftmost word)	
	b+12	---		Monitor 2 (rightmost word)	Monitor value specified for monitor 2 type.
	b+13	---		Monitor 2 (leftmost word)	
	b+14	---	Servo Parameter data	Read data (rightmost word)	Contains the Servo Parameter that was read.
	b+15	---		Read data (leftmost word)	
	b+16 to b+23	---	---	Not used (reserved by the system).	Always 0.

I/O	Word	Bits	Category	Name	Function
Input (PCU to CPU Unit)	b+24	00	Linear interpolation status	Linear interpolation setting completed (See note 1.)	0: Linear interpolation setting will be accepted. ↑: Linear interpolation setting accepted. 1: Linear interpolation setting completed. (New setting not accepted.)
		01 to 12		Not used (reserved by the system).	Always 0.
		13		Linear interpolation executing (See note 1.)	1: Linear interpolation operation in progress or linear interpolation command in progress.
		14 and 15		Not used (reserved by the system).	Always 0.

Note (1) Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) The emergency stop input status is input only for SMARTSTEP Junior Servo Drives. This status is not used (reserved by the system) for W-series Servo Drives.

Appendix D
List of Error Codes

PCU Common Errors

	Indicator status					Category	Error name	Error code
	RUN	ERC	ERH	ERM	MLK			
Errors at powerup	Not lit	Not lit	Not lit	Not lit	Not lit	CPU Unit power interruption	Power Interruption	---
						Unit system error	Watchdog Timer Operation	---
	Not lit	Not lit	Lit	Not lit	Not lit	Setting error	Unit Number Error	---
							Unit Recognition Incomplete	---
							Data Transfer Error	---
	Not lit	Lit	Not lit	Not lit	Not lit	Unit malfunction	Common Memory Error	---
	Not lit	Lit	Lit	Not lit	Not lit	Unit recognition error	Unit Recognition Error	---
CPU Unit errors	Lit	Flashing	Lit	Not lit	Not lit	CPU Unit error	CPU Fatal Error	000A
							CPU Unit Watchdog Timer Error	000B
							CPU Unit Monitor Error	000C
							Bus Error	000D
PCU internal errors	Lit	Lit	Not lit	Not lit	Not lit	Unit error	MLK Device Error	0026
							MLK Device Initialization Error	0030
						Data corrupted	Memory Error	00F1
MECHATROLINK communications errors	Lit	Flashing	Not lit	Lit	Undetermined	Scan list mismatch	MLK Initialization Error	0020
						Communications error	MLK Communications Error	0025
PCU settings and operations errors	Lit	Flashing	Not lit	Not lit	Undetermined	Illegal operation	Multistart Error	0021
							FINS Command Monitoring Error	0024
						Illegal data	Write Transfer Error	0022
							Read Transfer Error	0023
							Transfer Cycle Setting Error	0027
							Initialization Common Parameter Check Error	0028
							Data Transfer Common Parameter Check Error	0029

Individual Axis Errors

	Indicator status					Category	Error name	Error code
	RUN	ERC	ERH	ERM	MLK			
MECHATROLINK communications errors	Lit	Flashing	Not lit	Lit	Undetermined	Communications error	Synchronous Communications Alarm	3010
							Communications Alarm	3011
							Command Timeout	3012

	Indicator status					Category	Error name	Error code
	RUN	ERC	ERH	ERM	MLK			
PCU settings and operations errors	Lit	Flashing	Not lit	Not lit	Lit	Illegal operation	Present Position Unknown Error	3030
							Servo Unlock Error	3040
							Multistart Error	3050
PCU settings and operations errors	Lit	Flashing	Not lit	Not lit	Lit	Illegal data	Position Designation Error	3060
							Speed Designation Error	3061
							Speed Control Speed Designation Error	3062
							Torque Command Value Error	3063
							Option Command Value 1 Error	3064
							Option Command Value 2 Error	3065
							Override	3070
							Initialization Axis Parameter Check Error	3090
							Data Transfer Axis Parameter Check Error	3091
							Data Setting Error	3099
MECHATROLINK slave station device errors	Lit	Flashing	Not lit	Flashing	Lit	External sensor input	Forward Rotation Limit Input	3000
							Reverse Rotation Limit Input	3001
							Forward Software Limit	3002
							Reverse Software Limit	3003
							Emergency Stop Signal Input	3004
						Origin search error	No Origin Proximity or Origin Input Signal	3020
							Limit Input Already ON	3021
							Limit Input Signal ON in Both Directions	3022
						Servo Drive error	Drive Main Circuit OFF Error	3080
						MECHATROLINK device alarm		4000 + Alarm code for each device

Alarm Displays for Servo Drives

The following table lists the alarm displays for Servo Drives.

When an alarm or warning occurs for one of the connected MECHATROLINK slave station devices, the PCU turns ON the Error Flag or Warning Flag and returns the following error code.

G-series Servo Drives

Error code: 4□□□ hex

The numbers in the boxes of the error codes displayed for alarms are given as decimal numbers for the Servo Drives and as hexadecimal numbers for the Position Control Units.

The same numbers are given in the boxes of the error codes displayed for warnings for the Servo Drives and the Position Control Units.

Example: Position deviation overflow alarm (deviation counter overflow)

Servo Drive alarm display: A.24

The PCU's error code in this example is 4018.

Example: Battery warning

Servo Drive warning display: A.92

The PCU's error code in this example is 4092.

For details on alarm display and warning display numbers, and the difference between Servo Drives and Position Control Units, refer to the list in Appendix D List of Error Codes.

W-series and SMARTSTEP Junior Servo Drives

Error code: 40□□ hex

The boxes (□□) indicate the alarm/warning display number for the Servo Drive.

When using an R88D-WN□-ML2 W-series Servo Drive with built-in MECHATROLINK-II communications, however, only the upper two digits of the display number's three digits will be displayed.

The alarms that occur in the Servo Drive correspond to error codes that are detected by the PCU when a MECHATROLINK communications connection has been established, as shown in the following table.

When using an R88D-WT□ Servo Drive, the two digits following "A." in the Servo Drive's display number in the table are displayed. When using an R88D-WN□-ML2 W-series Servo Drive, three digits are displayed (the value indicated by the display number box is used to further classify the alarm).

For details on each alarm and countermeasures, refer to the operation manual for the Servo Drive being used.

List of G-series Alarm Displays

The Servo Drive has built-in protective functions. When a protective function is activated, the Servo Drive turns OFF the alarm output signal (ALM) and switches to the Servo OFF status.

The alarm code will be displayed on the front panel.

Alarm type	Description
---	Protective function that allows the alarm to be reset, and leaves record in the alarm history.
PR	Protective function that does not allow the alarm to be reset, and requires the control power supply to be turned OFF and turned ON again after resolving the problem.
X	Protective function that does not leave record in the alarm history.

Servo Drive display	PCU error code	Alarm type	Error detection function	Detected error or cause of error
A.11	400B	X	Control power supply undervoltage	The DC voltage of the main circuit has dropped below the specified value.
A.12	400C	---	Overvoltage	The DC voltage of the main circuit is abnormally high.
A.13	400D	X	Main power supply undervoltage	The DC voltage of the main circuit is low.
A.14	400E	PR	Overcurrent	Overcurrent flowed to the IGBT. Servomotor power line ground fault or short circuit.
A.15	400F	PR	Servo Drive overheat	The temperature of the Servo Drive radiator exceeded the specified value.
A.16	4010	---	Overload	Operation was performed with torque significantly exceeding the rating for several seconds to several tens of seconds.
A.18	4012	PR	Regeneration overload	The regenerative energy exceeded the processing capacity of the regeneration resistor.
A.21	4015	PR	Encoder communications error	Communications between the encoder and the Servo Drive failed for a specified number of times, thereby activating the error detection function.
A.23	4017	PR	Encoder communications data error	Communications error occurred for the data from the encoder.

Servo Drive display	PCU error code	Alarm type	Error detection function	Detected error or cause of error
A.24	4018	---	Deviation counter overflow	The number of position deviation pulses exceeded the Deviation Counter Overflow Level (Pn209).
A.26	401A	---	Overspeed	The rotation speed of the Servomotor exceeded the setting of the Overspeed Detection Level Setting (Pn073).
A.27	401B	PR	Command error	The operation command resulted in an error.
A.29	401D	---	Internal deviation counter overflow	The value of the internal deviation counter (internal control unit) exceeded 2^{27} (134217728).
A.34	4022	---	Overrun limit error	The Servomotor exceeded the allowable operating range set in the Overrun Limit Setting (Pn026) with respect to the position command input.
A.36	4024	PR X	Parameter error	Data in the parameter save area was corrupted when the data was read from the EEPROM at power-ON.
A.37	4025	PR X	Parameter corruption	The EEPROM write verification data was corrupted when the data was read from the EEPROM at power-ON.
A.38	4026	X	Drive prohibit input error	Forward and Reverse Drive Prohibit Inputs (NOT and POT) both became OPEN.
A.40	4028	PR	Absolute encoder system down error	The voltage supplied to the absolute encoder dropped below the specified value.
A.41	4029	PR	Absolute encoder counter overflow error	The multi-turn counter of the absolute encoder exceeded the specified value.
A.42	402A	PR	Absolute encoder over-speed error	The Servomotor rotation speed exceeded the specified value when power to the absolute encoder is supplied by the battery only.
A.44	402C	PR	Absolute encoder one-turn counter error	A one-turn counter error was detected.
A.45	402D	PR	Absolute encoder multi-turn counter error	A multi-turn counter error or phase-AB signal error was detected.
A.47	402F	---	Absolute encoder status error	The rotation of the absolute encoder is higher than the specified value.
A.48	4030	PR	Encoder phase Z error	A phase-Z pulse was not detected regularly.
A.49	4031	PR	Encoder PS signal error	A logic error was detected in the PS signal.
A.82	4052	PR	Node address setting error	The rotary switch for setting the node address of the Servo Drive was set out of range.
A.83	4053	---	Communications error	Data received during each MECHATROLINK-II communications cycle repeatedly failed, exceeding the number of times set in the Communications Control (Pn005).
A.84	4054	---	Transmission cycle error	While actuating MECHATROLINK-II communications, synchronization frames (SYNC) were not received according to the transmission cycle.
A.86	4056	---	Watchdog data error	Synchronization data exchanged between the master and slave nodes during each MECHATROLINK-II communications cycle resulted in an error.
A.87	4057	X	Emergency stop input error	The emergency stop input became OPEN.
A.90	405A	---	Transmission cycle setting error	The transmission cycle setting error when the MECHATROLINK-II CONNECT command is received.
A.91	405B	---	SYNC command error	A SYNC-related command was issued while MECHATROLINK-II was in asynchronous communications mode.
A.93	405D	PR	Parameter setting error	Parameter setting exceeded the allowable range.
A.95	405F	PR X	Servomotor non-conformity	The combination of the Servomotor and Servo Drive is not appropriate.
Others	Others	PR	Other errors	The control circuit malfunctioned due to excessive noise. An error occurred within the Servo Drive due to the activation of its self-diagnosis function.

List of G-series Warning Displays

Priority	Servo Drive display	PCU error code	Warning detection function	Warning details
High ↑	A.94	4094	Data setting warning	• Command argument setting is out of the range. • Parameter write failure. • Command settings are wrong, and others.
	A.95	4095	Command warning	• Command output conditions are not satisfied. • Received unsupported command. • Subcommand output conditions are not satisfied.
	A.96	4096	ML-II communications warning	One or more MECHATROLINK-II communications error occurred.
	A.90	4090	Overload warning	85% of the overload alarm trigger level has been exceeded.
	A.91	4091	Regeneration overload warning	85% of the regeneration overload alarm trigger level has been exceeded.
↓ Low	A.92	4092	Battery warning	Voltage of absolute encoder battery has dropped below 3.2 V.
	A.93	4093	Fan lock warning	The built-in cooling fan stopped, or rotated abnormally.

Note (1) All warnings are retained. After resolving the problem, clear the alarms and the warnings.

(2) When multiple warnings occur, the warning codes are displayed on the front panel in the order of their priority (shown above). The value read from the network is set.

List of W-series and SMARTSTEP Junior Alarm Display

Servo Drive display	PCU error code	Error detection function	Detected error or cause of error
A.02□	4002	Parameter corrupted	Parameter checksum read from EEPROM does not match.
A.03□	4003	Main circuit detection error	Error in detection data for power supply circuit
A.04□	4004	Parameter setting error	The parameter setting is incorrect.
A.05□	4005	Servomotor mismatch	The Servomotor and Servo Drive combination is incorrect.
A0b□ (See note 3.)	400B	Servo ON command disabled	The PCU sent a SERVO LOCK command when the Servo ON function was being used from personal computer monitoring software
A.10□	4010	Overcurrent	An overcurrent has occurred or the radiation shield has overheated (1.5- to 3-kW models only).
A.28 (See note 4.)	(See note 4.)	Emergency stop	The emergency stop signal was input while the motor was operating.
A.30□ (See note 5.)	4030	Regeneration error	The regenerative circuit is damaged due to large regenerative energy.
A.32□ (See note 5.)	4032	Regeneration overload	The regenerative energy has exceeded the regeneration resistor capacity.
A.33□ (See note 5.)	4033	Main-circuit power supply setting error	The setting of Pn001.2 (AC/DC input selection) and the AC/DC wiring method used for the main circuit power supply are not the same.
A.40□	4040	Overvoltage	The main circuit DC voltage has exceeded the specified values.
A.41□	4041	Undervoltage	The main circuit DC voltage is under the specified values.
A.51□	4051	Overspeed	The Servomotor rotation speed has exceeded the maximum rotation speed.
A52□ (See note 3.)	4052	Fluctuation or autotuning alarm	An abnormal fluctuation was detected in the Servomotor rotation speed, or the inertia ratio calculation during autotuning was abnormal.
A.71□	4071	Overload	Operating with output torque exceeding 245% of the rated torque for a W-series Servo Drive or exceeding 200% of the rated torque for a SMARTSTEP Junior Servo Drive.
A.72□	4072	Overload	Operation continuing with output torque at 120% to 245% of the rated torque for a W-series Servo Drive or at 115% to 200% of the rated torque for a SMARTSTEP Junior Servo Drive.
A.73□	4073	Dynamic brake overload	The rotary energy has exceeded the dynamic brake resistor capacity during dynamic brake operation.
A.74□ (See note 5.)	4074	Inrush resistance overload	The inrush current when power was turned ON exceeded the inrush resistor capacity.
A.7A□	407A	Overheat	Overheating in the radiation shield was detected or the cooling fan in the Servo Drive has stopped.
A.81□ (See note 5.)	4081	Backup error (Absolute encoders only)	The encoder's backup power supply has fallen.
A.82□ (See note 5.)	4082	Checksum error (Absolute encoders only)	An encoder memory checksum error has occurred.
A.83□ (See note 5.)	4083	Battery error (Absolute encoders only)	The encoder's battery voltage has fallen (to 2.7 V or lower).
A.84□ (See note 5.)	4084	Absolute error (Absolute encoders only)	An internal encoder data error has occurred.
A.85□ (See note 5.)	4085	Overspeed error (Absolute encoders only)	The Servomotor is rotating at 200 r/min. or more when the encoder power supply is turned ON.
A.86□ (See note 5.)	4086	Encoder overheating (Absolute encoders only)	Overheating in the encoder was detected.
A.b1 (See note 2.)	40B1	Speed command input reading error	The A/D completion signal from the A/D converter is not being output within the fixed interval.

Servo Drive display	PCU error code	Error detection function	Detected error or cause of error
A.b2 (See note 2.)	40B2	Torque command input reading error	The A/D completion signal from the A/D converter is not being output within the fixed interval.
A.b3□ (See note 3.)	40B3	Current detection error	The Servo Drive's current detector is faulty.
A.b6□	40B6	LSI for communications corrupted	The LSI used for MECHATROLINK communications is corrupted.
A.bF□	40BF	System error	A system error in the control circuit was detected.
A.C1□	40C1	Runaway detected	The Servomotor rotated in the opposite direction to the command.
A.C2 (See note 4.)	40C2	Phase detection error	A Servomotor magnetic pole signal was incorrectly detected.
A.C5 (See note 4.)	40C5	Magnetic pole detection error	A Servomotor magnetic pole signal was incorrectly detected.
A.C8□ (See note 5.)	40C8	Multi-turn data error (Absolute encoders only)	The absolute encoder setup is incorrect.
A.C9□	40C9	Encoder communications error	Communications between the encoder and Servo Drive are not possible.
A.CA□ (See note 5.)	40CA	Encoder parameter error	The parameter settings in the encoder are corrupted.
A.Cb□ (See note 5.)	40CB	Encoder data error	Data from the encoder is corrupted.
A.CC□ (See note 5.)	40CC	Multi-turn limit discrepancy (Absolute encoders only)	The absolute encoder multi-turn limit for the encoder and Servo Drive do not match.
A.d0□ (See note 5.)	40D0	Deviation counter overflow	The number of pulses in the deviation counter has exceeded the deviation counter overflow level set in Pn505 (R88D-WT□) or Pn520 (R88D-WN□-ML2).
A.d1□ (See note 5.)	40D1	Motor-load deviation over	The deviation between the fully-closed encoder and semi-closed encoder has reached or exceeded the command unit set in Pn51A.
A.E0□	See note 1.	No option or Servo Drive error	The MECHATROLINK-II Application Module is not installed, or the Servo Drive has malfunctioned.
A.E1 (See note 2.)	See note 1.	Option timeout	There is no response from the MECHATROLINK-II Application Module.
A.E2 (See note 2.)	See note 1.	Option WDC error	An error has occurred in the MECHATROLINK-II Application Module. (MECHATROLINK-II Application Module's watchdog timer count)
A.E4□ (See notes 3 and 4.)	40E4	Transfer cycle setting error	MECHATROLINK-II transfer cycle setting is incorrect.
A.E5□	40E5	Synchronization error	MECHATROLINK-II synchronization error
A.E6□	40E6	Communications error	MECHATROLINK-II communications error (Continuous communications errors have occurred.)
A.EA□	40EA	Servo Drive malfunction	The Servo Drive has malfunctioned.
A.EB (See note 2.)	40EB	Servo Drive initial access error	The Servo Drive initial processing cannot be executed from the MECHATROLINK-II Application Module.
A.EC (See note 2.)	40EC	Servo Drive error	An error has occurred in the Servo Drive. (Servo Drive's watchdog timer count)
A.Ed□	40ED	Command execution incomplete	MECHATROLINK communications command aborted during execution.
A.F1□ (See note 5.)	40F1	Missing phase detected	Main circuit power supply phase is missing, or the wire is burnt out.

Servo Drive display	PCU error code	Error detection function	Detected error or cause of error
A.F5 (See note 2.)	40F5	Motor current error	The current to the Servomotor is too small for the torque command from the Servo Drive.
A.F6 (See note 2.)	40F6	Motor conduction error	The Servo is ON, but the Servomotor is not conducting current regardless of the Servo Drive settings and external input.

Note (1) Errors that occur in the MECHATROLINK-II Application Module cannot be detected by the PCU because the communications connection is not established. The PCU is not able to detect the corresponding axis during execution of CONNECT, so an MLK Initialization Error (Unit error code: 0020 hex) will occur.

(2) This alarm occurs when using an R88D-WT□ W-series Servo Drive together with the JUSP-NS115 MECHATROLINK-II Application Module.

(3) This alarm occurs when using an R88D-WN□-ML2 W-series Servo Drive.

(4) This alarm may occur when a SMARTSTEP Junior Servo Drive (R7D-ZN□-ML2) is being used. The A.28 (emergency stop) alarm is treated as an emergency stop signal input error (axis error code: 3004 (hex) in the Position Control Unit and the Servo will be unlocked for the axis.

(5) This alarm is not detected for SMARTSTEP Junior Servo Drives (R7D-ZN□-ML2).

List of W-series and SMARTSTEP Junior Warning Displays

Servo Drive display	PCU error code	Warning detection function	Warning details
A.90□ (See note 1.)	4090	Deviation counter overflow	The number of pulses in the deviation counter has exceeded the deviation counter overflow level set in Pn505 (when using R88D-WT□) or Pn520 (when using R88D-WN□-ML2) multiplied by the rate (%) set in Pn51E.
A.91□	4091	Overload or fluctuation	This warning occurs before the Overload Alarm (A.71□, A.72□) occurs. If operation is continued in this state, an alarm may occur. This warning also occurs when an abnormal fluctuation is detected in the Servomotor rotation speed.
A.92□ (See note 1.)	4092	Regeneration overload	This warning occurs before the Regeneration Overload Alarm (A.32) occurs. If operation is continued in this state, an alarm may occur.
A.93□ (See note 1.)	4093	Battery warning (Absolute encoders only)	This warning occurs before the Battery Error (A.83) occurs. If the power is turned OFF, an alarm may occur the next time the power is turned ON. (Replace the battery while the control circuit power supply is ON.)
A.94□	See note 2.	Parameter setting warning	A value outside the setting range has been set for the MECHATROLINK slave station device.
A.95□	See note 2.	MECHATROLINK-II command warning	An illegal communications command or unsupported communications command has been sent to the MECHATROLINK slave station device.
A.96□	4096	Communications warning	A single MECHATROLINK-II communications error has occurred. (See note 3.)

Note (1) This warning is not detected for SMARTSTEP Junior Servo Drives (R7D-ZN□-ML2).

(2) If a Parameter Setting Warning or MECHATROLINK-II Command Warning occurs in the Servo Drive, a data setting error (axis error code: 3099 hex) will occur at the PCU, and the active axis in which the error occurred will decelerate to a stop.

(3) If a MECHATROLINK-II communications error occurs once independently, a communications warning occurs, and the PCU will perform a communications retry. If the communications warning occurs continually, a communications error will occur.

Appendix E
Changing to CS1W/CJ1W-NC271/471/F71 from CS1W/CJ1W-NC113/133/213/233/413/433

The settings and methods for using CS1W/CJ1W-NC271/471/F71 Position Control Units include those that are different from the pulse-output models (CS1W/CJ1W-NC113/133/213/233/413/433).

The following information is important when replacing equipment that uses pulse-output PCUs and pulse-input Servo Drives or Stepping Motor Drives with the CS1W/CJ1W-NC271/471/F71 PCU and MECHATROLINK-II-compatible Servo Drive.

Installation

- The Yaskawa JUSP-NS115 MECHATROLINK-II Application Module must be installed when using an R88D-WT□ OMRON W-series Servo Drive (without built-in MECHATROLINK-II communications). The JUSP-NS115 is installed on the right side of the Servo Drive, so make sure that sufficient space is provided around the Servo Drive.
- R88D-WT□ W-series Servo Drives must be Ver.39 or later. The Servo Drive must be changed if an earlier version is being used. The Servomotor, power cables, and encoder cables, however, can be used as is without changing.

Wiring

- MECHATROLINK-II Cables are used for the connection between the PCU and Servo Drive (MECHATROLINK-II Application Module). The cables for pulse-output PCUs and Servo Relay Units cannot be used.
- The external sensor signals, such as limit inputs and origin proximity inputs, are connected to the Servo Drive's control I/O connector (CN1). The Servo Drive's CN1 connector must be wired.
- Emergency stop input signals are not provided as external input signals for the PCU or Servo Drive. To ensure safety in the system, provide safety measures in external circuits (i.e., not in the Programmable Controller or Position Control Unit), such as using a breaker for the Servo Drive's main circuit power supply.
- To perform an origin search, the origin proximity input signal must be used. Make sure that the dog width of the limit input signal and origin proximity input signal remains at the length of the MECHATROLINK-II communications cycle or longer.

System Configuration

Pulse-output PCUs are classified as CS/CJ-series Special I/O Units, whereas CS1W/CJ1W-NC271/471/F71 PCUs are classified as CS/CJ-series CPU Bus Units. Make sure that the PCU's unit number is not already used by another CPU Bus Unit and that the area allocated to the PCU in the PLC is not occupied by another Unit.

PCU Parameters and Operating Data

The functions and classification of the PCU's parameters and operating data are shown in the following table.

CS1W/CJ1W-NC113/133/213/233/413/433		CS1W/CJ1W-NC271/471/F71	
Item	**Setting**	**Item**	**Setting**
Common Parameter Area	Used to allocate the Operating Data Area and designates the Axis Parameters. The area is set in the PLC's DM Area words allocated to Special I/O Units.	Common Parameter Area	Used to allocate the Axis Operating Memory Areas and MECHATROLINK communications settings. The settings are written to the PCU's internal memory using the data transfer functions.
Axis Parameter Area	Used to allocate each Axis's operating mode, maximum speed, and software limits. The area is set in the PLC's DM Area words allocated to Special I/O Units or in the PCU's internal memory.	Axis Parameter Areas Axis Operating Memory Area Servo Parameter Area	The Axis Parameter Areas are used to select operating modes (origin search) and input signals. The settings are written to the PCU's internal memory using the data transfer functions. Some Axis Parameters are set as command values in the Axis Operating Memory Areas and are used as operating data. Other existing PCU Axis Parameters are set to the corresponding Servo Parameters.
Operating Memory Area	Used to input and output bit data, such as operating command outputs and status (flags) inputs. The area is allocated in the Special I/O Unit Area and is determined according to the unit number set for the PCU.	Axis Operating Memory Area Servo Parameter Area	The I/O information (bit and word data) is handled in the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas as output data and input data, respectively. The Axis Operating Output Memory Areas and Axis Operating Input Memory Areas are allocated in the PLC's memory according to the settings in the Common Parameters. Acceleration/deceleration data is set in the Servo Parameters.
Operating Memory Data	Used to input and output parameter data, such as position command value outputs and present position inputs. The area is allocated in the PLC's DM Area according to the setting in the Common Parameter Area.		
Memory operation data	Used to set the position/speed data for memory operations. The settings are written to the PCU's internal memory using the data transfer functions.	---	Memory operation functions are not provided.
Zone data	Used to set the zones. The settings are written to the PCU's internal memory using the data transfer functions.	---	A zone function is not provided.
---	---	Common Operating Memory Area	Performs operations common to the PCU such as MECHATROLINK communications control. The allocated area is contained in the PLC's CPU Bus Unit Memory Area according to the PCU's unit number.

A comparison of individual parameters and operating data, and operating precautions are provided in the following pages.

Common Parameter Area

CS1W/CJ1W-NC113/133/213/233/413/433		CS1W/CJ1W-NC271/471/F71	
	Setting		**Setting**
m	Operating Data Area designation	Common Parameter Area	Used to allocate Axis Operating Memory Areas and to perform MECHATROLINK communications settings. The settings are written to the PCU's internal memory using the data transfer functions.
m+1	Beginning word of the Operating Data Area		
m+2	Axis Parameters designation		

Axis Parameter Area

To use data in the CS1W/CJ1W-NC271/471/F71 that was set as Axis Parameters in the earlier PCUs, the data must be converted either to corresponding settings in the Axis Parameter Area and Servo Parameter Area, or assigned in the Axis Operating Output Memory Area as command values used as operating data.

The setting location in the CS1W/CJ1W-NC271/471/F71 corresponding to the Axis Parameters in earlier PCUs and the differences between the different parameters is shown in the following table.

The Axis Parameter addresses shown for CS1W/CJ1W-NC113/133/213/233/413/433 are those for the X axis. The setting locations in the CS1W/CJ1W-NC271/471/F71 indicated as word d in the Axis Parameters and word a in the Axis Operating Output Memory Area can be calculated using the following equations.

d = 1860 hex + (Axis No. −1) × 14 hex

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

G-series Servo Drives

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0004	I/O settings	00	Output pulse selection	---	---	Output pulse selection is not provided, so this parameter setting is not available.
		01 to 03	Not used.	---	---	---
		04	Limit input signal type	Servo Parameter Area	Pn404	Sets input allocations for the forward/reverse drive prohibited signals. The input signal logic cannot be set.
		05	Origin proximity input signal type	Servo Parameter Area	Pn042	Sets the input signal logic using the input allocations for the origin return deceleration LS signals.
		06	Origin input signal type	---	---	The input signal logic cannot be set.
		07	Emergency stop input signal	---	---	The input signal logic cannot be set.
		08	Origin undefined designation	---	---	This parameter setting is not available. The Servo Drive's feedback position is obtained. Therefore, the origin is not lost even when operation stops due to an external sensor.
		09 to 15	Not used.	---	---	---
0005	Operation mode selection	00 to 03	Operation mode	Axis Parameter Area word d+1	Bits 00 to 03	Not used. Operation mode selection is not provided, so this parameter setting is not available.
		04 to 07	Origin search operation		Bits 04 to 07	This parameter setting is the same.
		08 to 11	Origin detection method		Bits 08 to 11	Not used. Origin searches always use the origin proximity input signal. The origin detection method is fixed as the method that receives the origin input signal after the origin proximity input signal turns from ON to OFF. (This method corresponds with the setting when the origin detection method in the earlier PCUs is set to 0.)
		12 to 15	Origin search direction		Bits 12 to 15	This parameter setting is the same. Servo Parameter Pn10F (Origin Return Mode Settings), however, must be set at the same time to the same setting as for this parameter. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)
0006	Maximum speed (rightmost word)			---	---	A maximum speed setting is not provided. The maximum speed is clamped at approximately 110% when a speed command is sent for a value that is equal or higher than the Servo Drive's (Servomotor's) maximum speed.
0007	Maximum speed (leftmost word)					

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0008	Initial speed (rightmost word)			---	---	An initial speed setting is not provided. The acceleration/deceleration settings, however, enable two-step acceleration/deceleration curves and exponential acceleration/deceleration curves with bias. (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0009	Initial speed (leftmost word)					
000A	Origin search high speed (rightmost word)			Axis Operating Output Memory Areas	Word a+4 Word a+5	The origin search high speed is the speed command value for origin searches and is designated with the operating command in the Axis Operating Output Memory Areas.
000B	Origin search high speed (leftmost word)					
000C	Origin search proximity speed (rightmost word)			Servo Parameter Area	Pn110 Pn111	Sets the Servo Parameters Pn110 (Origin Return Approach Speed 1) and Pn111 (Origin Return Approach Speed 2). The setting unit is ×100 command units/s. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)
000D	Origin search proximity speed (leftmost word)					
000E	Origin compensation value (rightmost word)			Servo Parameter Area	Pn204	The amount of compensation positioning after detection of the origin input signal is set in Servo Parameter Pn204 (Origin Return Final Distance). (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)
000F	Origin compensation value (leftmost word)					
0010	Backlash compensation			Servo Parameter Area	Pn100 Pn101	The backlash compensation is set in Servo Parameters Pn101 (Backlash Compensation) and Pn100 (Backlash Compensation Selection). (For details, refer to *10-7 Backlash Compensation*.)
0011	Backlash compensation speed (rightmost word)			---	---	Backlash compensation is executed by adding it to the amount of movement for positioning, so these parameter settings are not supported.
0012	Backlash compensation speed (leftmost word)					
0013	Acceleration/deceleration curves			Axis Operating Output Memory Areas	Word a+16, bits 03 to 04	The acceleration/deceleration curves are designated with the operating command in the Axis Operating Output Memory Areas as command values for executing positioning operations.
0014	Origin search acceleration time (rightmost word)			Servo Parameter Area	Pn107	The acceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameter Pn107 (Linear Acceleration Constant). (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0015	Origin search acceleration time (leftmost word)					
0016	Origin search deceleration time (rightmost word)			Servo Parameter Area	Pn10A	The deceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameter Pn10A (Linear Deceleration Constant). (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0017	Origin search deceleration time (leftmost word)					

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0018	Positioning monitor time			---	---	A positioning monitor is not provided, so this parameter setting is not available. Refer to the programming examples and set a timing monitor in the user program. (Refer to *11-2-6 Positioning (Absolute Movement or Relative Movement)*.)
0019	CCW software limit (rightmost word)			Servo Parameter Area	Pn201	The forward software limit is set in Servo Parameter Pn201 (Forward Software Limit) in command units. (For details, refer to *10-8 Software Limits*.)
001A	CCW software limit (leftmost word)					
001B	CW software limit (rightmost word)			Servo Parameter Area	Pn202	The reverse software limit is set in Servo Parameter Pn202 (Reverse Software Limit) in command units. (For details, refer to *10-8 Software Limits*.)
001C	CW software limit (leftmost word)					
001D	Reserved by the system.			---	---	---
001E	Reserved by the system.			---	---	---
001F	Initial pulse designation			---	---	Initial pulse designation is not provided, so this parameter setting is not available.

W-series Servo Drives

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0004	I/O settings	00	Output pulse selection	---	---	Output pulse selection is not provided, so this parameter setting is not available.
		01 to 03	Not used.	---	---	---
		04	Limit input signal type	Servo Parameter Area	Pn50A.3 Pn50B.0	Sets the input signal logic using the input allocations for the forward/reverse drive prohibited signals.
		05	Origin proximity input signal type	Servo Parameter Area	Pn511.0	Sets the input signal logic using the input allocations for the origin return deceleration LS signals.
		06	Origin input signal type	Servo Parameter Area	Pn511.1 Pn511.2 Pn511.3	Sets the input signal logic according to the input allocations for the external latch signal when external latch signal is selected as the origin input signal. This setting is not available when the Servomotor phase Z signal is selected as the origin input signal.
		07	Emergency stop input signal	---	---	An emergency stop input signal is not provided, so this parameter is not available. The stop methods used for limit inputs and software limits, however, can be specified in Servo Parameter Pn001.1. (For details, refer to *7-5 Limit Input Operations*.)
		08	Origin undefined designation	---	---	This parameter setting is not available. The Servo Drive's feedback position is obtained. Therefore, the origin is not lost even when operation stops due to an external sensor.
		09 to 15	Not used.	---	---	---
0005	Operation mode selection	00 to 03	Operation mode	Axis Parameter Area word d+1	Bits 00 to 03	Not used. Operation mode selection is not provided, so this parameter setting is not available.
		04 to 07	Origin search operation		Bits 04 to 07	This parameter setting is the same.
		08 to 11	Origin detection method		Bits 08 to 11	Not used. Origin searches always use the origin proximity input signal. The origin detection method is fixed as the method that receives the origin input signal after the origin proximity input signal turns from ON to OFF. (This method corresponds with the setting when the origin detection method in the earlier PCUs is set to 0.)
		12 to 15	Origin search direction		Bits 12 to 15	This parameter setting is the same. Servo Parameter Pn816 (zero point return direction), however, must be set at the same time to the same setting as for this parameter. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0006	Maximum speed (rightmost word)			---	---	A maximum speed setting is not provided. The maximum speed is clamped at approximately 110% when a speed command is sent for a value that is equal or higher than the Servo Drive's (Servomotor's) maximum speed.
0007	Maximum speed (leftmost word)					
0008	Initial speed (rightmost word)			---	---	An initial speed setting is not provided. The acceleration/deceleration settings, however, enable two-step acceleration/deceleration curves and exponential acceleration/deceleration curves with bias. (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0009	Initial speed (leftmost word)					
000A	Origin search high speed (rightmost word)			Axis Operating Output Memory Areas	Word a+4 Word a+5	The origin search high speed is the speed command value for origin searches and is designated with the operating command in the Axis Operating Output Memory Areas.
000B	Origin search high speed (leftmost word)					
000C	Origin search proximity speed (rightmost word)			Servo Parameter Area	Pn817 Pn818	Sets the Servo Parameters Pn817 (zero point return approach speed 1) and Pn818 (zero point return approach speed 2). The setting unit is ×100 command units/s. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)
000D	Origin search proximity speed (leftmost word)					
000E	Origin compensation value (rightmost word)			Servo Parameter Area	Pn819 Pn81A	The amount of compensation positioning after detection of the origin input signal is set in Servo Parameter Pn819 (final travel distance to return to zero point). (For details, refer to *8-2-3 Data Settings Required for Origin Search*.)
000F	Origin compensation value (leftmost word)					
0010	Backlash compensation			Servo Parameter Area	Pn81B Pn81D.0 Pn207.2 Pn214	The backlash compensation is set in Servo Parameters Pn81B (backlash compensation amount) and Pn81D.0 (backlash compensation direction) when using R88D-WT□ Servo Drives and in Pn207.2 (backlash compensation selection) and Pn214 (backlash compensation amount) when using R88D-WN□-ML2 Servo Drives. (For details, refer to *10-7 Backlash Compensation*.)
0011	Backlash compensation speed (rightmost word)			---	---	Backlash compensation is executed by adding it to the amount of movement for positioning, so these parameter settings are not supported.
0012	Backlash compensation speed (leftmost word)					
0013	Acceleration/deceleration curves			Axis Operating Output Memory Areas	Word a+16, bits 03 to 04	The acceleration/deceleration curves are designated with the operating command in the Axis Operating Output Memory Areas as command values for executing positioning operations.

CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
Word	**Name**	**Bit**	**Setting**	**Setting location**		**Difference**
0014	Origin search acceleration time (rightmost word)			Servo Parameter Area	Pn80A Pn80B Pn80C	The acceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameters Pn80A, Pn80B, and Pn80C. (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0015	Origin search acceleration time (leftmost word)					
0016	Origin search deceleration time (rightmost word)			Servo Parameter Area	Pn80D Pn80E Pn80F	The deceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameters Pn80D, Pn80E, and Pn80F. (For details, refer to *7-4 Acceleration and Deceleration Operations*.)
0017	Origin search deceleration time (leftmost word)					
0018	Positioning monitor time			---	---	A positioning monitor is not provided, so this parameter setting is not available. Refer to the programming examples and set a timing monitor in the user program. (Refer to *11-2-6 Positioning (Absolute Movement or Relative Movement)*.)
0019	CCW software limit (rightmost word)			Servo Parameter Area	Pn804 Pn805	The forward software limit is set in Servo Parameters Pn804 and Pn805 in command units. (For details, refer to *10-8 Software Limits*.)
001A	CCW software limit (leftmost word)					
001B	CW software limit (rightmost word)			Servo Parameter Area	Pn806 Pn807	The reverse software limit is set in Servo Parameters Pn806 and Pn807 in command units. (For details, refer to *10-8 Software Limits*.)
001C	CW software limit (leftmost word)					
001D	Reserved by the system.			---	---	---
001E	Reserved by the system.			---	---	---
001F	Initial pulse designation			---	---	Initial pulse designation is not provided, so this parameter setting is not available.

Operating Memory Area

In the CS1W/CJ1W-NC271/471/F71 PCU, the Operating Memory Area allocations and functions have changed, as shown in the following table.

A comparison of the functions of these words is provided in the following table. The differences between the functions, such as in axis operations executed by the Operating Memory Area words, are explained later in this appendix.

Operating Memory Area words for CS1W/CJ1W-NC113/133/213/233/413/433 PCUs are shown in the following table as those for the X axis of the CS1W/CJ1W-NC113 PCU, and the beginning word n is calculated using the following equation.

n = 2000 + (unit number × 10)

The Operating Memory Area words for CS1W/CJ1W-NC271/471/F71 PCUs are calculated for each axis using the following equation.

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
	Word	Bits	Category	Name	Word	Bits	Differences
Output (CPU Unit to PCU)	n	00	Memory operation commands	Sequence Number Enable	a	00	Used as linear interpolation command bits. Memory operation functions are not provided, so memory operation command bits are not allocated.
		01		START		01	
		02		INDEPENDENT START		02	
		03	Direct operation commands	ABSOLUTE MOVEMENT		03	The function of this bit is the same.
		04		RELATIVE MOVEMENT		04	The function of this bit is the same.
		05		INTERRUPT FEEDING		05	The method for starting interrupt feeding has been changed. This bit is an Interrupt Feeding Designation Bit for ABSOLUTE/RELATIVE MOVEMENT, and is used together with ABSOLUTE/RELATIVE MOVEMENT bits.
		06	Origin positioning commands	ORIGIN SEARCH		06	The function of this bit is the same.
		07		ORIGIN RETURN		07	The function of this bit is the same.
		08		PRESENT POSITION PRESET		08	The function of this bit is the same. When the DECELERATION STOP Bit is ON, however, PRESENT POSITION PRESET cannot be received.

I/O	CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
	Word	Bits	Category	Name	Word	Bits	Differences
Output (CPU Unit to PCU)	n	09	Commands for special functions	JOG	a	09	The function of this bit is the same.
		10		Direction designation		10	The function of this bit is the same for JOG direction. The rotation direction cannot be designated for interrupt feeding.
		11		TEACH		11	Not used. A teaching function is not provided, so this bit is not allocated.
		12		ERROR RESET/RELEASE PROHIBIT		12	The function of this bit is the same for resetting errors that occur in individual axes. The function to release prohibit on pulse outputs is not provided. The function to reset Unit common errors is allocated in the Common Operating Memory Area.
		13		Deviation counter reset output/origin-adjustment command output		13	Same bit function as the deviation counter reset for PCUs with unit versions 1.3 or later. This function, however, does not turn on the deviation counter reset output but rather starts the DEVIATION COUNTER RESET command. (For PCUs with unit versions 1.2 or earlier, counter reset output and origin-adjustment command output functions are not provided, so this bit is not allocated.)
		14		Override Enable		14	The function of this bit is the same.
		15		(DECELERATION) STOP		15	The function of this bit is the same.
	n+1	00		Not used.	a+1	00	Used as the SERVO LOCK Bit.
		01		Not used.		01	Used as the SERVO UNLOCK Bit.
		02		Not used.		02	Used as the SPEED CONTROL Bit.
		03		Not used.		03	Used as the TORQUE CONTROL Bit.
		04 to 07		Not used.		04 to 07	Not used.
		08		FORCED INTERRUPT		08	Not used. A forced interrupt start function is not provided, so this bit is not allocated.
		09 to 10		Not used.		09 to 10	Not used.
		11		Not used.		11	Used as the DEVICE SETUP Bit.
		12	Data transfer commands	WRITE DATA		12	Used as the WRITE SERVO PARAMETER Bit. The PCU's WRITE DATA Bit is allocated in the Common Operating Memory Area.
		13		READ DATA		13	Used as the READ SERVO PARAMETER Bit. The PCU's READ DATA Bit is allocated in the Common Operating Memory Area.
		14		SAVE DATA		14	Used as the SAVE SERVO PARAMETER Bit. The PCU's SAVE DATA Bit is allocated in the Common Operating Memory Area.

I/O	CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
	Word	Bits	Category	Name	Word	Bits	Differences
Output (CPU Unit to PCU)	n+1	15	Data transfer commands	Not used.	a+1	15	Used as the EMERGENCY STOP Bit. The Servomotor stops after moving for the amount of pulses remaining the Servo Drive's deviation counter when this bit turns ON.
Input (PCU to CPU Unit)	n+2	00	PCU status	Not used.	b	00	Used as the Receiving Command Flag.
		01 to 03		Not used.		01 to 03	Not used.
		04		Waiting for Memory Operation Flag		04	Not used. Memory operation functions are not provided, so this bit is not allocated.
		05		Positioning Completed Flag		05	The function of this bit is the same. Name: PCU Positioning Completed Flag
		06		No Origin Flag		06	The function of this bit is the same. The conditions whereby the origin is lost after being established are different from earlier PCUs.
		07		Origin Stop Flag		07	This flag functions in the same way, showing whether the present position is within the origin positioning range (zero point width). This flag turns ON when the origin is passed, which is different from earlier PCUs.
		08		Zone 0 Monitor Flag		08	Not used. A zone function is not provided, so these bits are not allocated.
		09		Zone 1 Monitor Flag		09	
		10		Zone 2 Monitor Flag		10	
		11		Teaching Completed Flag		11	A teaching function is not provided. This bit is used as a Warning Flag.
		12		Error Flag		12	The function of this bit is the same for errors that occur in individual axes. The error flags for Unit common errors are allocated as Unit Error Flags in the Common Operating Memory Area.
		13		Busy Flag		13	The function of this bit is the same for indicating busy status of functions for individual axes. The busy status for Unit common functions (including Unit initial processing) is allocated as Unit Busy Flags in the Common Operating Memory Area.
		14		Data Transferring Flag		14	Used as the Servo Parameter Transferring Flag. The PCU's Data Transferring Flag is allocated as the Data Transferring Flag in the Common Operating Memory Area.
		15		Deceleration Stop Execution Flag		15	The function of this bit is the same. The EMERGENCY STOP Bit is turned ON by executing EMERGENCY STOP, however, and not by an external input (the CS1W/CJ1W-NC271/471/F71 does not have emergency stop inputs).

I/O	CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
	Word	Bits	Category	Name	Word	Bits	Differences
Input (PCU to CPU Unit)	n+3	00	External I/O status	Not used.	b+3	00	Used as the forward rotation limit input signal status.
		01		Not used.		01	Used as the reverse rotation limit input signal status.
		02		Not used.		02	Used as the origin proximity input signal status.
		03		Not used.		03	Used as the encoder phase A input signal status.
		04		Not used.		04	Used as the encoder phase B input signal status.
		05		Not used.		05	Used as the encoder phase Z input signal status.
		06		Not used.		06	Used as the external latch signal 1 input signal status.
		07		Not used.		07	Used as the external latch signal 2 input signal status.
		08		CW limit input signal		08	Used as the external latch signal 3 input signal status. The forward rotation limit input signal status is allocated to bit 00 of this word (b+3).
		09		CCW limit input signal		09	Used as the brake output signal status. The reverse rotation limit input signal status is allocated to bit 01 of this word (b+3).
		10		Origin proximity input signal		10	This bit is reserved by the system. The origin proximity input signal status is allocated to bit 02 of this word (b+3).
		11		Origin input signal		11	This bit is reserved by the system. The origin input status is provided either in bit 05 of this word (b+3) when phase Z input signal is set or in bits 06 to 08 of this word when the external latch signal is set, according to the selected signal.
		12		Interrupt input signal		12	This bit is reserved by the system. The interrupt input signal status is provided in bits 06 to 08 of this word (b+3) according to the external latch signal.
		13		Emergency stop input signal		13	An emergency stop input signal is not provided. This bit is reserved by the system.
		14		Positioning completed input signal		14	This bit is reserved by the system. The Servo Drive's positioning completed signal status (indicating that the deviation counter is within the *Positioning Completion Range 1*) is allocated as the Position Completed (PSET) Flag in bit 07 of word b+2 (Servo Status Flags) in the Axis Operating Input Memory Area.
		15		Deviation counter reset output/origin-adjustment command output		15	An deviation counter reset output/origin-adjustment command output is not provided as an external output. This bit is reserved by the system.

I/O	CS1W/CJ1W-NC113/133/213/233/413/433				CS1W/CJ1W-NC271/471/F71		
	Word	Bits	Category	Name	Word	Bits	Differences
Input (PCU to CPU Unit)	n+4	---	Error code	Error code	b+4	---	The function of this word is the same for errors that occur in individual axes. The error codes for Unit common errors are allocated as Unit error codes in the Common Operating Memory Area.

Operating Data Area

The operating data designated in the data memory of earlier PCUs is allocated in the CS1W/CJ1W-NC271/471/F71 in either the Common Operating Memory Area or Axis Operating Memory Area, as shown in the following table.

A comparison of the functions for these words is provided in the following table. The differences between these functions, such as in axis operations executed by the Operating Memory Area bits, are explained later in this appendix.

Operating Data Area words for CS1W/CJ1W-NC113/133/213/233/413/433 PCUs are shown in the following table for the X axis of the CS1W/CJ1W-NC113 PCU. The beginning word "I" is allocated in either the Special I/O Unit Area or a user-specified DM/EM Area using settings in the Common Parameters.

The Operating Memory Area words for CS1W/CJ1W-NC271/471/F71 PCUs are allocated either to the Common Operating Memory Area or Axis Operating Memory Area, which are calculated using the following equations.

n = CIO 1500 + (unit number × 25)

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

I/O	CS1W/CJ1W-NC113/133/213/233/413/433			CS1W/CJ1W-NC271/471/F71	
	Word	Category	Name	Word	Differences
Output (CPU Unit to PCU)	I	Operating data for data transfer	Number of write words	n+6	The function is the same as data for WRITE DATA used to transfer PCU parameters. The data transferring method for the WRITE SERVO PARAMETER function is different.
	I+1		Write source area	n+7	
	I+2		Write source word	n+8	
	I+3		Write destination address	n+9	
	I+4		Number of read words	n+10	The function is the same as data for READ DATA used to transfer PCU parameters. The data transferring method for the READ SERVO PARAMETER function is different.
	I+5		Read source address	n+11	
	I+6		Read destination area	n+12	
	I+7		Read destination word	n+13	
	I+8	Operating data for direct operation	Position (rightmost word)	a+2	The function of these words is the same. The data unit, however, is the command unit determined according to the setting for the electronic gear.
	I+9		Position (leftmost word)	a+3	
	I+10		Speed (rightmost word)	a+4	The function of these words is the same. The data unit, however, is the command unit/s determined according to the setting for the electronic gear.
	I+11		Speed (leftmost word)	a+5	
	I+12		Acceleration time (rightmost word)	---	The acceleration and deceleration times cannot be set in the PLC's memory area as operating data. The acceleration/deceleration constants are set by transferring them as Servo Parameters using the Servo Parameter transferring functions.
	I+13		Acceleration time (leftmost word)		
	I+14		Deceleration time (rightmost word)		
	I+15		Deceleration time (leftmost word)		

I/O	CS1W/CJ1W-NC113/133/213/233/413/433			CS1W/CJ1W-NC271/471/F71	
	Word	Category	Name	Word	Differences
Output (CPU Unit to PCU)	I+16	Operating data for memory operation	Sequence number	---	Memory operation functions are not provided, so this data is not allocated.
	I+17	Operating data for special functions	Override	a+14	Override ratio (unit: 0.01%)
	I+18		Teaching address	---	Memory operation functions are not provided, so this data is not allocated.
	I+19		Not used.	---	---
Input (PCU to CPU Unit)	I+20	PCU status	Present position (rightmost word)	b+6	This word functions as a feedback present position (rightmost word). The command present position (rightmost word) is allocated in word b+8.
	I+21		Present position (leftmost word)	b+7	This word functions as a feedback present position (leftmost word). The command present position (leftmost word) is allocated in word b+9.
	I+22		Sequence number	---	Memory operation functions are not provided, so this data is not allocated.
	I+23		Output code	---	Output code functions are not provided, so this data is not allocated.

Functions

The main functions of the W-series Servo Drives are explained here.

ORIGIN SEARCH

Acceleration/Deceleration Settings

The acceleration/deceleration settings for origin searches are set in the parameters for each axis in earlier PCUs, but they are set in the Servo Parameters (using Servo Parameter transfer functions) of the CS1W/CJ1W-NC271/471/F71.

CS1W/CJ1W-NC113/133/213/233/413/433

The time from the initial speed until the maximum speed is reached is set in the following axis parameters.

Origin search acceleration time (ms)
Origin search deceleration time (ms)

Each parameter setting is transferred to the PCU using data transfer functions (data transfer bit or IOWR instruction), or transferred automatically from the DM Area allocated to Special I/O Units when the PCU power is turned ON or the Unit is restarted.

CS1W/CJ1W-NC271/471/F71

The rate of increase or decrease in speed within a specified time unit is set in the following Servo Parameters.

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/ deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0

Each parameter is set in the Servo Drive via the PCU using the PCU's Servo Parameter transfer functions (WRITE/SAVE SERVO PARAMETER Bits).

When using a trapezoidal curve (linear acceleration/deceleration) with the initial speed set to 0 (pulses/s), the set values for the origin search acceleration time and origin search deceleration time used in the earlier PCUs are converted to the following settings.

Pn80A (first-step linear acceleration constant):

The origin search uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80B (second-step linear acceleration constant):

The maximum speed, initial speed, and origin search acceleration time in the axis parameters of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80B} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Origin search acceleration time} \times 10} (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80C (acceleration constant switching speed):

The origin search uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

Pn80D (first-step linear deceleration constant):

The origin search uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80E (second-step linear deceleration constant):

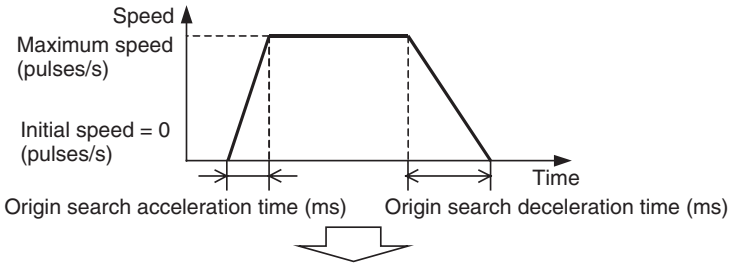
The maximum speed, initial speed, and origin search deceleration time in the axis parameters of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80E} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Origin search deceleration time} \times 10} (\times 10{,}000 \text{ pulses/s}^2)$$

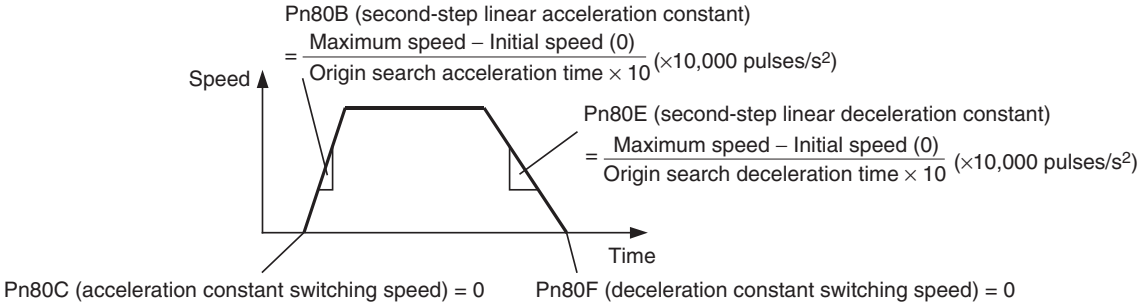
Pn80F (deceleration constant switching speed):

The origin search uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

CS1W/CJ1W-NC113/133/213/233/413/433



CS1W/CJ1W-NC271/471/F71


Pn80B (second-step linear acceleration constant) = Maximum speed – Initial speed (0) / Origin search acceleration time × 10 (×10,000 pulses/s²)
Speed
Pn80E (second-step linear deceleration constant) = Maximum speed – Initial speed (0) / Origin search deceleration time × 10 (×10,000 pulses/s²)
Time
Pn80C (acceleration constant switching speed) = 0
Pn80F (deceleration constant switching speed) = 0

Origin Search High Speed

The origin search high speed (speed until detection of the origin proximity input signal) is set in the axis parameters in earlier PCUs. In the CS1W/CJ1W-NC271/471/F71, however, this parameter value is set as the *Speed Command Value* for origin searches in the Axis Operating Output Memory Area when the origin search is started.

Origin Search Proximity Speed

The origin search proximity speed (speed after detection of the origin proximity input signal until detection of the origin input signal) is set in the axis parameters in earlier PCUs. In the CS1W/CJ1W-NC271/471/F71, however, this parameter value is set as the *Zero Point Return Approach Speed 1* (Pn817) in the Servo Parameter Area.

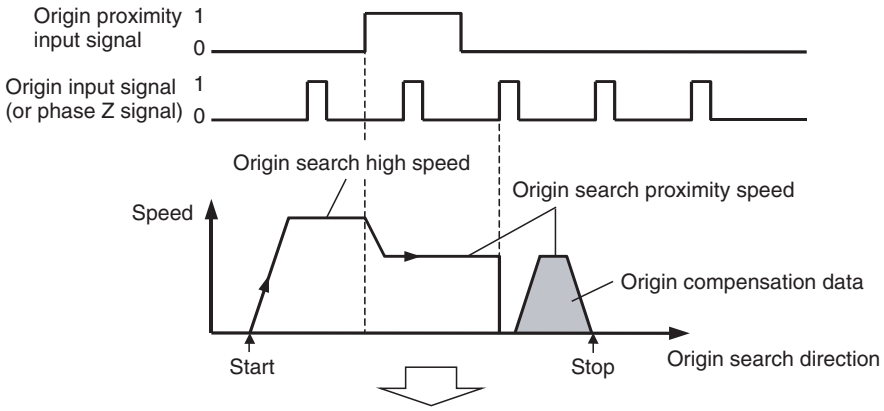
The setting unit for the *Zero Point Return Approach Speed 1* parameter is 100 command units/s. Therefore, to set the command unit to pulses, the set value for earlier PCUs must be multiplied by 1/100 to obtain the set value required for CS1W/CJ1W-NC271/471/F71 PCUs.

Origin Compensation

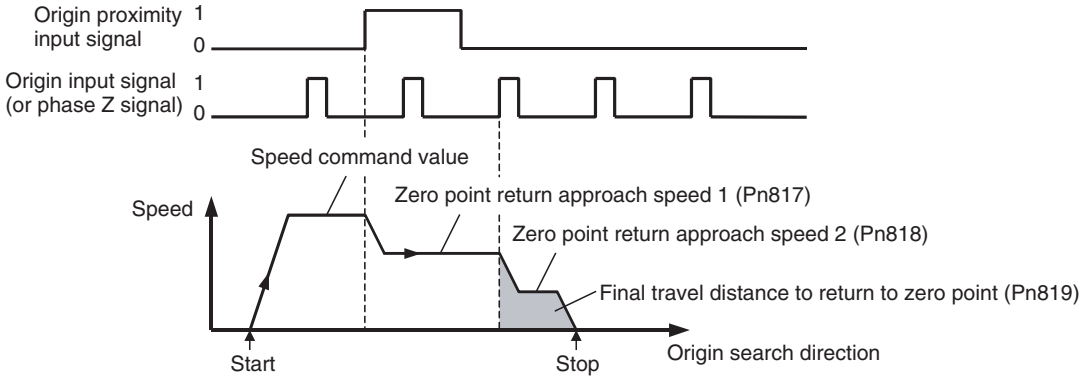
When using origin compensation in earlier PCUs, positioning was executed for the amount of origin compensation data at the origin search proximity speed. This operation is performed after first stopping the search operation using origin input signal detection.

For CS1W/CJ1W-NC271/471/F71 PCUs, origin compensation is performed following origin input signal detection by executing positioning using the Servo Parameters *Zero Point Return Approach Speed 2* (Pn818) and *Final Travel Distance to Return to Zero Point* (Pn819).

CS1W/CJ1W-NC113/133/213/233/413/433



CS1W/CJ1W-NC271/471/F71



Origin Established and No Origin Status

The No Origin Flag in both earlier PCUs and the CS1W/CJ1W-NC271/471/F71 indicates whether the origin has been established or not. The differences in the conditions whereby the No Origin Flag turns ON or OFF are as follows:

	CS1W/CJ1W-NC113/133/213/233/413/433	CS1W/CJ1W-NC271/471/F71
Initial status (when power is turned ON)	(After PCU's initial processing is completed) ON status (origin not established)	Same as left
ON condition (Origin is lost)	• At power up, or restart • When executing ORIGIN SEARCH (See note.) • When the emergency stop input signal or limit input signal is input (if origin undefined designation of I/O settings (for x axis, word 0004 bit 08) in the axis parameters is set so)	• At power up, or restart • When connection is released (if CONNECT Bit is turned OFF or the connection is released due to an error) • When DEVICE SETUP is executed
OFF condition (Origin is established)	• When ORIGIN SEARCH execution is completed • When PRESENT POSITION PRESET is executed	• When ORIGIN SEARCH execution is completed • When PRESENT POSITION PRESET is executed When using absolute encoders: • When connection is established • When SERVO LOCK is executed

Note In earlier PCUs, if ORIGIN SEARCH is executed again after establishing the origin, the origin will be lost (until ORIGIN SEARCH execution is completed). In the CS1W/CJ1W-NC271/471/F71, however, once the origin has been established, the origin will not be lost, even if ORIGIN SEARCH is executed again. If ORIGIN SEARCH is executed again, the search operation will be executed using the coordinates based on the previous origin until the new origin is established. When the software limits are enabled at this point, the software limits will apply to the origin search operation, causing operation to stop due to an error. (Positioning will not be reversed at the software limits when origin searches are performed in reversal mode.)

Position Control (Direct Operation)

Acceleration/Deceleration Settings

The acceleration/deceleration settings for position control (direct operation) are specified in the Operating Data Area at start up in earlier PCUs. In CS1W/CJ1W-NC271/471/F71 PCUs, however, these settings are set in the Servo Parameters (using Servo Parameter transfer functions).

CS1W/CJ1W-NC113/133/213/233/413/433:

The following operation data is designated for the time from the initial speed until the maximum speed is reached.

Acceleration time (ms)
Deceleration time (ms)

For each parameter, the data that has been set in the Operating Data Area is enabled when the direct operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT) is started.

CS1W/CJ1W-NC271/471/F71

The rate of increase or decrease in speed within a specified time unit is set in the following Servo Parameters.

Type	Parameter No.	Parameter name	Unit	Setting range	Parameter size	Default setting
Acceleration/deceleration constants	Pn80A	First-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80B	Second-step linear acceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80C	Acceleration constant switching speed	100 command units/s	0 to 65535	2	0
	Pn80D	First-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80E	Second-step linear deceleration constant	10,000 command units/s^2	1 to 65535	2	100
	Pn80F	Deceleration constant switching speed	100 command units/s	0 to 65535	2	0

Each parameter is set in the Servo Drive via the PCU using the PCU's Servo Parameter transfer functions (WRITE/SAVE SERVO PARAMETER Bits).

When a trapezoidal curve (linear acceleration/deceleration) is used with the initial speed set to 0 (pulses/s), the set values for the acceleration time and deceleration time in the Operating Data Area of the earlier PCUs are converted to the following settings.

Pn80A (first-step linear acceleration constant):
The operation uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80B (second-step linear acceleration constant):
The maximum speed and initial speed in the axis parameters and the acceleration time in the Operating Data Area of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80B} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Acceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80C (acceleration constant switching speed):
The operation uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

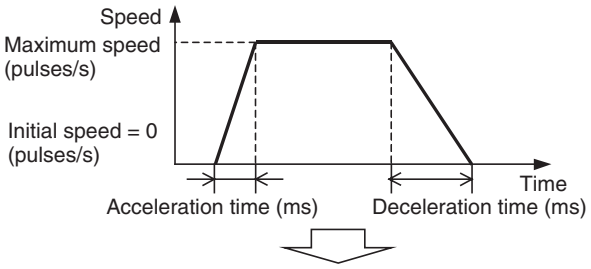
Pn80D (first-step linear deceleration constant):
The operation uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80E (second-step linear deceleration constant):
The maximum speed and initial speed in the axis parameters and the deceleration time in the Operating Data Area of earlier PCUs are converted to the value determined from the following equation.

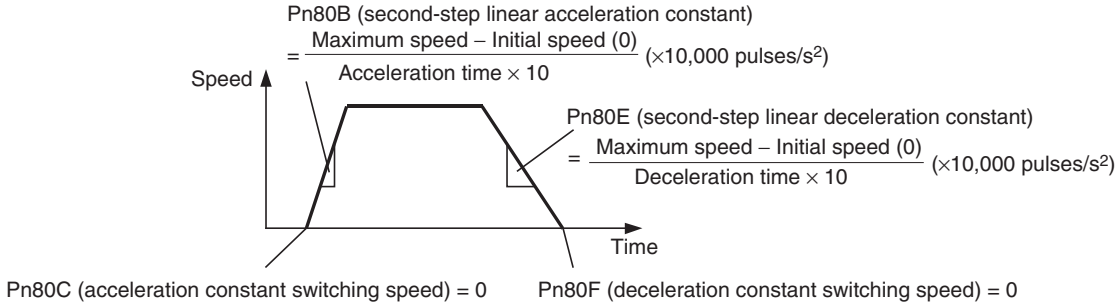
$$\text{Pn80E} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Deceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80F (deceleration constant switching speed):
The operation uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

CS1W/CJ1W-NC113/133/213/233/413/433



CS1W/CJ1W-NC271/471/F71


Pn80B (second-step linear acceleration constant)
= Maximum speed – Initial speed (0) / Acceleration time × 10 (×10,000 pulses/s²)
Speed
Pn80E (second-step linear deceleration constant)
= Maximum speed – Initial speed (0) / Deceleration time × 10 (×10,000 pulses/s²)
Time
Pn80C (acceleration constant switching speed) = 0
Pn80F (deceleration constant switching speed) = 0

Changing Target Position and Changing Target Speed

The target position and target speed can be changed during axis operation in the same way for both earlier PCUs and the CS1W/CJ1W-NC271/471/F71 PCU by using the following operation.

Changing target position: Set the new target position in *Position Command Value* and send an operation command again. (Strictly speaking, the new target position is to be set in Position of the Operating Data Area for earlier PCUs while it is set in Position Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NC271/471/F71 PCUs.)

Changing target speed: Change *Speed Command Value* during axis operation to immediately change the target speed. (Strictly speaking, the new target speed is to be set in Speed of the Operating Data Area for earlier PCUs while it is set in Speed Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NC271/471/F71 PCUs.)

When changing the target position with a CS1W/CJ1W-NC271/471/F71 PCU, however, the Receiving Command Flag must be used to control the ON/OFF timing for the operation command bits.

Interrupt Feeding

Interrupt feeding in earlier PCUs is executed by independently operating individual start bits. With CS1W/CJ1W-NC271/471/F71 PCUs, however, interrupt feeding is an additional function for the direct operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT).

To execute interrupt feeding, turn ON the Interrupt Feeding Designation Bit in the Axis Operating Output Memory Area and execute ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

When using earlier PCUs, interrupt feeding functions by switching from speed control to position control (positioning is performed for the amount of interrupt feeding after detection of the interrupt input signal). With CS1W/CJ1W-NC271/471/F71 PCUs, however, interrupt feeding functions by switching from one position control operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT) to another position control operation (positioning is performed for the amount of interrupt feeding after detection of the interrupt input signal), and if an interrupt input signal is not input, the original positioning operation is completed.

Memory Operation

Memory operation functions are not provided in CS1W/CJ1W-NC271/471/F71 PCUs.

The teaching function, forced interrupt operation, and output codes, which are related to memory operations, are also not provided.

Operations that use automatic patterns and continuous patterns must be created in the user program.

Jogging

Acceleration/Deceleration Settings

In earlier PCUs, the acceleration/deceleration settings for jogging are specified as operation data in the Operating Data Area when jogging is started. In CS1W/CJ1W-NC271/471/F71 PCUs, however, these settings are set in the Servo Parameters (using Servo Parameter transfer functions).

Details on acceleration/deceleration settings are the same as those provided for position control (direct operation), so refer to the section on position control (direct operation).

Changing Target Speed

The target speed can be changed during jogging operations in the same way for both earlier PCUs and the CS1W/CJ1W-NC271/471/F71 PCU by using the following operation.

Changing target speed: Change the *Speed Command Value* parameter during jogging operations to immediately change the target speed. (Strictly speaking, the new target speed is to be set in Speed of the Operating Data Area for earlier PCUs while it is set in Speed Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NC271/471/F71 PCUs.)

Present Position

Earlier PCUs use open-loop control, and monitor the command position (PCU's output pulses) as the present position. CS1W/CJ1W-NC271/471/F71 PCUs exchange data with Servo Drives that have a semi-closed loop configuration. Therefore, both the feedback present position (total of feedback pulses from the Servomotor's encoder) and command present position (total of PCU's position command values) are monitored as the present position.

Data Transfer

In earlier PCUs, all the parameters set by the PCU are in the Unit, and data is transferred using the PCU's data transfer functions (data transfer bit or IOWR instruction).

In CS1W/CJ1W-NC271/471/F71 PCUs, however, data is classified into three types: Common Parameters, Axis Parameters, and Servo Parameters. Common Parameters and Axis Parameters are configured in the PCU, and Servo Parameters are configured in the Servo Drive. Therefore, the transfer functions used to transfer the parameters in the PCU are different than those used to transfer the parameters in the Servo Drive.

- Common Parameters and Axis Parameters
  These parameters are transferred to the PCU using the data transfer bits (WRITE DATA, READ DATA, and SAVE DATA) in the Common Operating Memory Area.
- Servo Parameters
  These parameters are transferred to each axis using the Servo Parameter transfer bits (WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER) in the Axis Operating Output Memory Area. Parameters are transferred between the PLC and Servo Drive by executing these Servo Parameter transfer functions.

The IOWR and IORD instructions are not supported by the CS1W/CJ1W-NC271/471/F71 PCUs.

Appendix F
Additional Functions for the CJ1W-NCF71-MA

Overview

The following functions have been added to those of the CJ1W-NCF71 Position Control Unit to produce the CJ1W-NCF71-MA Position Control Unit.

- Interpolation axis stop mode setting for linear interpolation
- Allowed interaxial deviation setting for linear interpolation

Note The CS1W-NC271/471/F71 and CJ1W-NC271/471/F71 do not have the functions described in this appendix. To use these functions, use the CJ1W-NCF71-MA. If data is backed up from a CJ1W-NCF71 Position Control Unit on a Memory Card mounted in the CPU Unit (using either the CPU Unit's simple backup function or the Position Control Unit's backup function), do not read that data to a CJ1W-NCF71-MA Position Control Unit. It will not be possible to use the additional functions if data backed up from a CJ1W-NCF71 is downloaded to a CJ1W-NCF71-MA. To move CJ1W-NCF71 setting data to the CJ1W-NCF71-MA, be sure to use the parameter transfer function or CX-Motion-NCF Support Software to read, write, and save to memory the data in the Common Operating Memory Area. Also, do not download CJ1W-NCF71-MA Memory Card backup data to the CJ1W-NCF71.

Interpolation Axis Stop Mode Setting for Linear Interpolation

With the linear interpolation function of the CJ1W-NCF71, the other interpolation axes will decelerate to a stop if an error occurs on any of the interpolation axes, an axis is stopped (deceleration stop or emergency stop), or SERVO UNLOCK is executed during linear interpolation. The CJ1W-NCF71-MA enables selecting the stop mode of the other interpolation axes when this occurs with settings in the Axis Operating Output Memory Areas of axis 2 (for the combination of axes 1 to 4) or axis 6 (for the combination of axes 5 to 8).

Operating Output Memory Area for Axis 2 and Axis 6

Name	Word	Bits	Description
Interpolation Axis Stop Mode	a+21 (Axis Operating Output Memory Area for Axis 2)	00 to 03	Axis 1 stop mode in linear interpolation for combinations of axes 1 to 4. 0: Deceleration stop (default) 1: Emergency stop 2: Servo unlock
		04 to 07	Same as above for axis 2 stop mode
		08 to 11	Same as above for axis 3 stop mode
		12 to 15	Same as above for axis 4 stop mode
	a+21 (Axis Operating Output Memory Area for Axis 6)	00 to 03	Axis 5 stop mode in linear interpolation for combinations of axes 5 to 8. 0: Deceleration stop (default) 1: Emergency stop 2: Servo unlock
		04 to 07	Same as above for axis 6 stop mode
		08 to 11	Same as above for axis 7 stop mode
		12 to 15	Same as above for axis 8 stop mode

a = Beginning word of Axis Operating Output Memory Areas in Common Parameters + (Axis No. −1) × 25

Select the stop operation for other interpolation axes if an error occurs on any of the interpolation axes, the axis is stopped (deceleration stop or emergency stop), or SERVO UNLOCK is executed during operation of linear interpolation. The setting can be made for each axis of linear interpolation combinations of axes 1 to 4 or for each axis of linear interpolation combinations of axes 5 to 8.

If a value outside the range is set, the system will treat it as if 0 was selected (i.e., deceleration stop). The interpolation axis stop mode setting is enabled when the LINEAR INTERPPOLATION START Bit turns ON.

Example:

If the beginning word of the Axis Operating Output Memory Areas is set to CIO 4000, the interpolation stop mode for linear interpolation of a combination of axes 1 to 4 will be set in a+21 (CIO 4046) of the Operating Output Memory Area of axis 2.

The first word of the Operating Output Memory Area of axis 2 is calculated as follows:

$a = 4000 + (2-1) \times 25 = \text{CIO } 4025$

In this case, the following settings will be used for the interpolation axis stop mode of each axis from 1 to 4.

Axis 1 interpolation axis stop mode: CIO 4046.00 to CIO 4046.03
Axis 2 interpolation axis stop mode: CIO 4046.04 to CIO 4046.07
Axis 3 interpolation axis stop mode: CIO 4046.08 to CIO 4046.11
Axis 4 interpolation axis stop mode: CIO 4046.12 to CIO 4046.15

In the same way, the interpolation stop mode for linear interpolation of a combination of axes 5 to 8 will be set in a+21 (CIO 4146) of the Operating Output Memory Area of axis 6.

The first word of the Operating Output Memory Area of axis 6 is calculated as follows:

$a = 4000 + (6 - 1) \times 25 = \text{CIO } 4125$

The following settings will be used for the interpolation axis stop mode of each axis.

Axis 5 interpolation axis stop mode: CIO 4146.00 to CIO 4146.03
Axis 6 interpolation axis stop mode: CIO 4146.04 to CIO 4146.07
Axis 7 interpolation axis stop mode: CIO 4146.08 to CIO 4146.11
Axis 8 interpolation axis stop mode: CIO 4146.12 to CIO 4146.15

Allowed Interaxial Deviation Setting for Linear Interpolation

If the deviation in feedback present positions between axes 1 and 2 or axes 5 and 6 exceeds the allowed deviation that is set in the parameters for each axis, both axes 1 and 2 or both axes 5 and 6 will be decelerated to a stop. It is thus possible to automatically stop axis operation in response to deviation that occurs, for example, because of an error for one of the axes, when bilateral operation is performed with two axes.

The allowed deviation between axes is specified in the Axis Operating Output Memory Area of axis 2 for linear interpolation operation using combinations of axes 1 to 4 and in Axis Operating Output Memory Area of axis 6 for linear interpolation operation using combinations of axes 5 to 8.

Axis Operating Output Memory Areas for Axis 2 and Axis 6

Name	Word	Bits	Contents
Allowed Interaxial Deviation	a+23 a+24 (Axis Operating Output Memory Area for Axis 2)	---	Allowed deviation between axes 1 and 2 (a+23: lower word, a+24: upper word) Unit: Command unit Setting range: 0 to 2,147,483,647 The allowed deviation between axes 1 and 2 in linear interpolation for a combination of axes 1 to 4 will be set in 32-bit signed hexadecimal. The allowed deviation between axes 1 and 2 will not be detected if the setting is 0 (default) or a negative value.
	a+23 a+24 (Axis Operating Output Memory Area for Axis 6)	---	Allowed deviation between axes 5 and 6 (a+23: lower word, a+24: upper word) Unit: Command unit Setting range: 0 to 2,147,483,647 The allowed deviation between axes 5 and 6 in linear interpolation for a combination of axes 5 to 8 will be set in 32-bit signed hexadecimal. The allowed deviation between axes 5 and 6 will not be detected if the setting is 0 (default) or a negative value.

a = Beginning word of Axis Operating Output Memory Areas in Common Parameters + (Axis No. −1) × 25

Example:

If the beginning word of the Axis Operating Output Memory Areas is set to CIO 4000, the allowed interaxial deviation for linear interpolation of a combination of axes 1 to 4 will be set in a+23 (CIO 4048) anda+24 (CIO 4049) of the Operating Output Memory Area of axis 2.

The first word of the Operating Output Memory Area of axis 2 is calculated as follows:

$a = 4000 + (2-1) \times 25 = \text{CIO } 4025$

In the same way, the allowed interaxial deviation for linear interpolation of a combination of axes 5 to 8 will be set in a+23 (CIO 4148) anda+24 (CIO 4149) of the Operating Output Memory Area of axis 6.

The first word of the Operating Output Memory Area of axis 6 is calculated as follows:

$a = 4000 + (6-1) \times 25 = \text{CIO } 4125$

The allowed deviation is found by comparing the difference in feedback present positions. Make settings so that operation starts from same present positions for axes 1 and 2 or axes 5 and 6 if detecting interaxial deviation is to be enabled (i.e., if the interaxial deviation is set to a positive number). Also, if either axis 1 or 2 or either axis 5 or 6 will be used for linear interpolation, set the allowed interaxial deviation of each axis to 0 (i.e., do not detect interaxial deviation). The setting of the allowed interaxial deviation becomes enabled when the setting is written to memory.

Note The CJ1W-NCF71-MA is treated as the CJ1W-NCF71 in the CX-Programmer, CX-Motion-NCF, and other Support Software. Select the CJ1W-NCF71 to make settings for the CJ1W-NCF71-MA when using Support Software.

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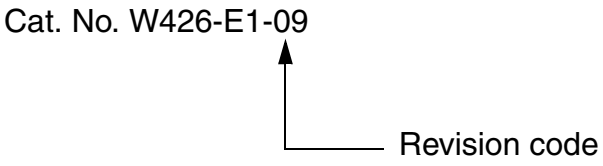
Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	July 2004	Original production
02	September 2004	Information was expanded and revised to include new functionality, and corrections were made, as follows: **Page xii:** Information on unit versions added. **Page 5:** Information on linear interpolation added. **Pages 6, 9, 122, 164, 240, 243, 245, and 300:** Information on torque corrected. **Pages 64, 65, 66, 97, 98, 99, 100, 107, 371, 372, 375, and 388:** Tables expanded and notes added. **Page 149:** Notes added. **Pages 165, 233, and 241:** Table revised. **Page 206:** Information on ABSOLUTE MOVEMENT added. **Page 218:** Subsection on linear interpolation added. **Pages 336 and 337:** Information added. **Page 342:** Note added.
03	April 2005	Revisions were made throughout the manual to include new functionality for the upgrade to unit version 1.2 and information on R88D-WN□-ML2 W-series Servo Drives with built-in MECHATROLINK-II communications that differs from information for R88D-WT□ W-series Servo Drives equipped with Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.
04	February 2006	Revisions were made throughout the manual to include new functionality for the upgrade to unit version 1.3 and to include the new CS-series PCU.
05	December 2006	Revisions were made throughout the manual to include new functionality for the upgrade to unit version 2.0 and to support SMARTSTEP Junior Servo Drives (R7D-ZN□-ML2).
06	August 2007	**Pages 202 and 274:** Information added on setting the transfer cycle and communications cycle when setting an absolute encoder zero point position offset for an origin search.
07	February 2008	New functionality for the upgrade to unit version 2.1 were added, additional descriptions were added, and errors were corrected.
08	August 2008	Added information on G-series Servo Drives (R88D-GN□ML2). Added explanations and corrected mistakes.
09	October 2008	Added the CS1W-NC271/471, CJ1W-NC271/471, and CJ1W-NCF71-MA and corrected mistakes.

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